Homologation

Fixtured Spindle

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

Serial no.: 756057

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Homologation: 2BD-2B200A-2K3D-2ZB SN: 756057

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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: **756057**

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

Hard joint (H)	449,14	Nm / Revolution	Angle degree	30°
Soft joint (L)	36,95	Nm / Revolution	Angle degree	360°

		H	L
a)	Tolerance down / up	68,82 79,18 Nm	68,82 - 79,18 Nm
	Tolerance down / up	7	7 %
	Average torque	74,86	73,89 Nm
	Standard deviation	0,16	0,16 Nm
	Torque scatter (99,73%)	0,99	0,94 Nm
	C_m	10,48	11,02
	C_{mk}	8,74	10,79

b)	Min. C_m hard/soft (lowest value)	10,48
	Min. C_{mk} hard/soft (lowest value)	8,74

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

Note:

Machine Capability Study
Control System

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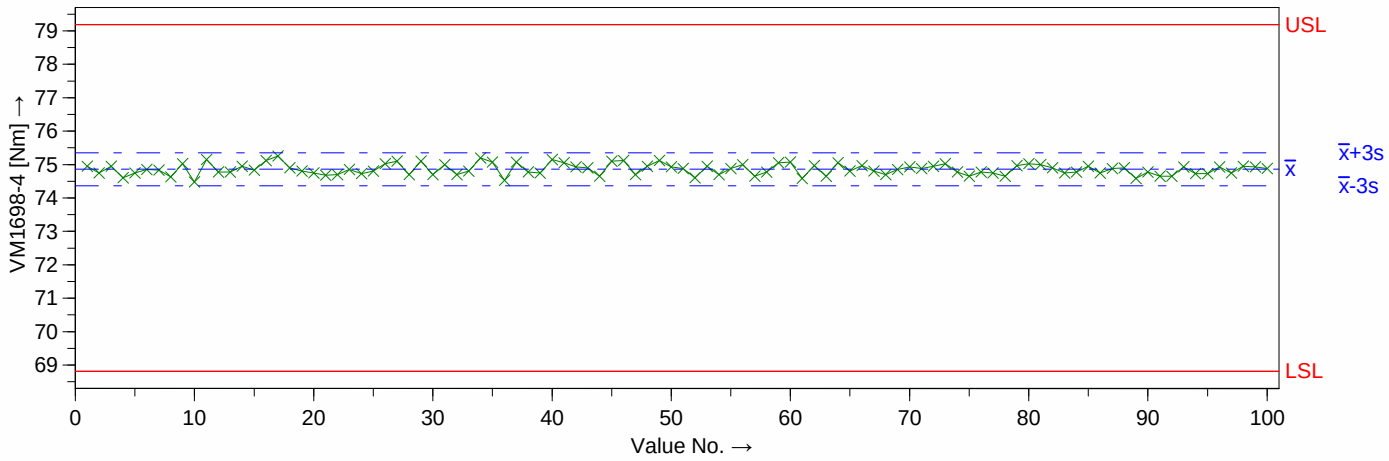
Plant ATG Westhausen		Operator Name Sünder	Date 29.04.2022

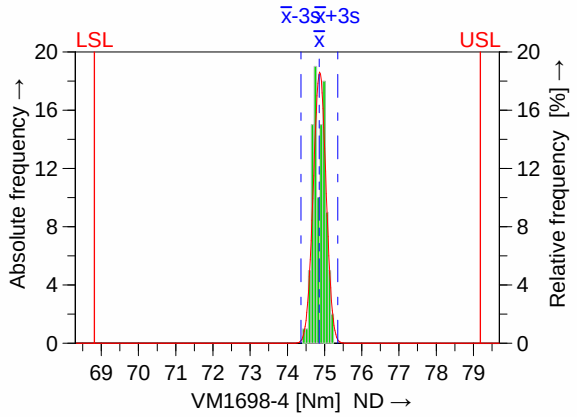
Ord. No. 2BD200T1S-A	Part type 2BD-2B200A-2K3D-2ZB				Contr.item yes
Serial No. 756057_d	Char.Descr. VM1698-4	Nom.val.	74,00	5,18	USL 79,18
	Serial No. 1024210	Unit	Nm	-5,18	LSL 68,82
Char.Type variable		Tolerance value	7 %		Decimal Pl. 2

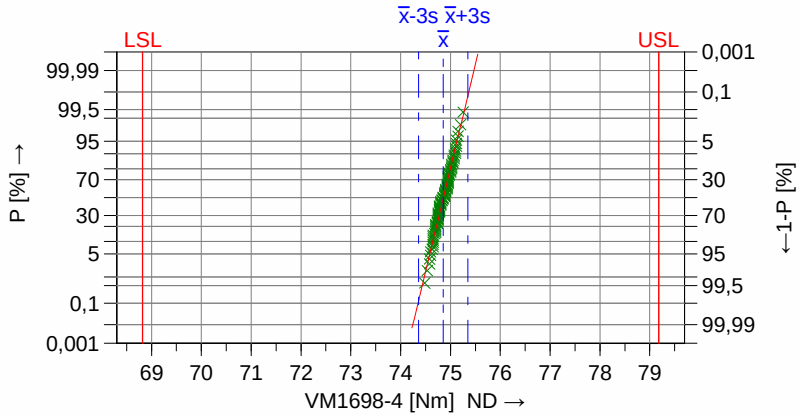
Cust.Name Cleco	Reference System VM1698-4	Test Electronic MPRO400GCD-P
Contr.No. Homologation	Reference Transducer 120 / 1019923	nges. 100

Evaluation from 29.04.2022 10:09:17 to 29.04.2022 10:22:29

Rem. TQ 30% hard +/-7% * TQ-Cal.: 200 Nm; Cur-Cal.: 5.744 Nm/A; Speed: 502/50 rpm;







Drawing Values		Collected Values		Statistics	
T_m	74.00			$\bar{x}$	74.8571
LSL	68.82	x_{min}	74.48	$\bar{x}$-3s	74.3627
USL	79.18	x_{max}	75.25	$\bar{x}$+3s	75.3515
T	10.36	R	0.77	6s	0.9888
		$n_{<T>}$	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	10.48
Critical capability index	=	C_{mk}	8.74

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 29.04.2022

Serial No.	756057_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.: 5.744 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	74,95	74,75	74,95	74,60	74,75	74,85	74,83	74,63	75,02	74,48
1024210	VM1698-4	Grad	28,50	29,25	29,75	29,50	29,50	29,50	29,00	29,00	29,50	29,50

Char.No.	Char.Descr.	Unit	x_{11}	x_{12}	x_{13}	x_{14}	x_{15}	x_{16}	x_{17}	x_{18}	x_{19}	x_{20}
1024210	VM1698-4	Nm	75,15	74,78	74,78	74,95	74,83	75,12	75,25	74,90	74,80	74,75
1024210	VM1698-4	Grad	29,50	30,75	29,25	31,00	29,25	31,00	29,50	29,00	30,25	28,75

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	74,68	74,70	74,85	74,73	74,80	75,02	75,10	74,70	75,10	74,70
1024210	VM1698-4	Grad	28,50	28,50	29,75	30,00	31,25	29,50	29,50	29,50	29,50	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	75,00	74,70	74,80	75,20	75,07	74,53	75,07	74,78	74,75	75,15
1024210	VM1698-4	Grad	29,50	29,50	30,75	29,50	29,75	29,75	30,25	30,25	28,75	30,00

Char.No.	Char.Descr.	Unit	x_{41}	x_{42}	x_{43}	x_{44}	x_{45}	x_{46}	x_{47}	x_{48}	x_{49}	x_{50}
1024210	VM1698-4	Nm	75,05	74,93	74,90	74,65	75,10	75,12	74,70	74,95	75,12	74,93
1024210	VM1698-4	Grad	30,25	29,50	31,00	29,50	30,50	29,25	29,25	30,25	30,00	29,25

Char.No.	Char.Descr.	Unit	x_{51}	x_{52}	x_{53}	x_{54}	x_{55}	x_{56}	x_{57}	x_{58}	x_{59}	x_{60}
1024210	VM1698-4	Nm	74,88	74,60	74,95	74,70	74,88	75,00	74,65	74,78	75,05	75,07
1024210	VM1698-4	Grad	29,50	29,50	29,50	29,75	29,75	29,50	29,75	28,75	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	74,58	74,97	74,65	75,05	74,80	74,97	74,80	74,70	74,85	74,93
1024210	VM1698-4	Grad	29,25	29,75	30,25	29,75	28,75	30,00	31,25	29,50	29,75	31,75

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	74,88	74,95	75,02	74,78	74,65	74,78	74,75	74,65	74,97	75,02
1024210	VM1698-4	Grad	30,50	30,50	29,25	29,50	30,00	30,00	29,50	30,00	29,75	29,50

Machine Capability Study
Control System

Plant	ATG Westhausen		Operator Name	Sünder	Date 29.04.2022

Serial No.	756057_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.: 5.744 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	75,00	74,90	74,75	74,78	74,95	74,75	74,88	74,90	74,58	74,78
1024210	VM1698-4	Grad	29,00	31,00	29,75	29,25	29,00	30,00	29,50	29,75	30,75	29,25

Char.No.	Char.Descr.	Unit	x_{91}	x_{92}	x_{93}	x_{94}	x_{95}	x_{96}	x_{97}	x_{98}	x_{99}	x_{100}
1024210	VM1698-4	Nm	74,65	74,65	74,93	74,73	74,73	74,93	74,75	74,95	74,93	74,88
1024210	VM1698-4	Grad	30,00	31,50	29,75	29,50	30,00	30,00	30,50	29,75	31,50	30,00

Machine Capability Study
Tool System

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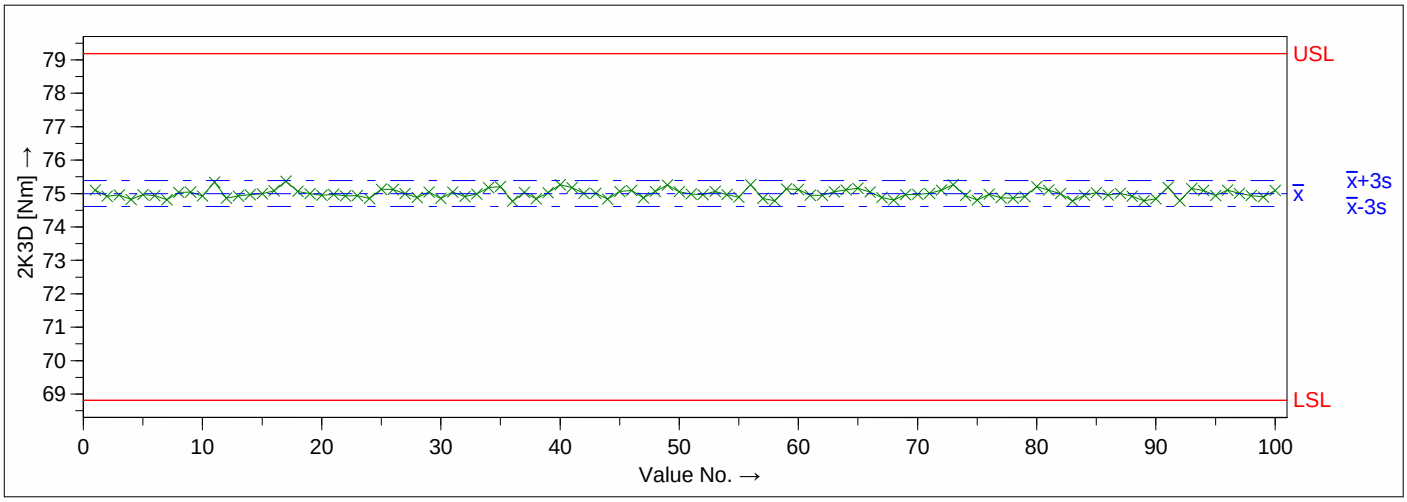
Plant ATG Westhausen		Operator Name Sünder	Date 29.04.2022

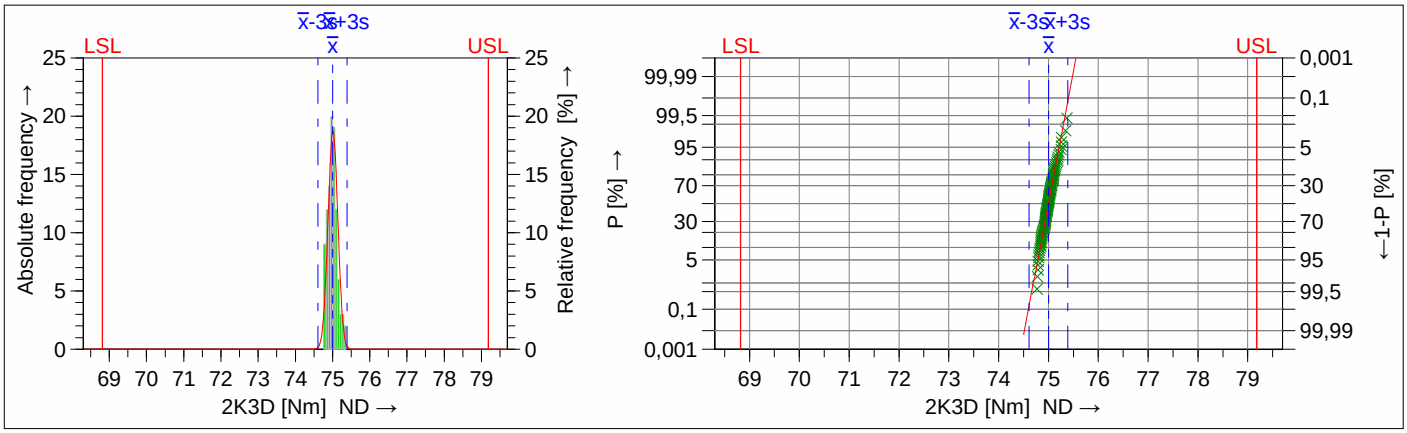
Ord. No. 2BD200T1S-A	Part type 2BD-2B200A-2K3D-2ZB				Contr.item yes
Serial No. 756057_d	Char.Descr. 2K3D	Nom.val.	74,00	5,18	USL 79,18
	Serial No. 206285	Unit	Nm	-5,18	LSL 68,82
Char.Type variable		Tolerance value	7 %		Decimal Pl. 2

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

Evaluation from 29.04.2022 10:09:18 to 29.04.2022 10:22:30

Rem. TQ 30% hard +/-7% * TQ-Cal.: 200 Nm; Cur-Cal.: 5.744 Nm/A; Speed: 502/50 rpm;





Drawing Values		Collected Values		Statistics	
T_m	74.00			$\bar{x}$	74.9990
LSL	68.82	x_{min}	74.77	$\bar{x}$-3s	74.6098
USL	79.18	x_{max}	75.37	$\bar{x}$+3s	75.3882
T	10.36	R	0.60	6s	0.7784
		$n_{<T>}$	100	$p_{<T>}$	100.00000 %
		$n_{>USL}$	0	$p_{>USL}$	0.00000%
		$n_{<LSL}$	0	$p_{<LSL}$	0.00000%
		n_{eff}	100		
		n_{tot}	100		

Model distribution			Normal Distribution
Calculation method			M1 1.4 $\hat{\sigma}$ = S_{tot}
Potential Capability index	=	C_m	13.31
Critical capability index	=	C_{mk}	10.74

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 29.04.2022

Serial No.	756057_d	Characteristic			
Part type	2BD-2B200A-2K3D-2ZB	Char.Descr.	2K3D	Nom.val.	74,00
Ord. No.	2BD200T1S-A	Serial No.	206285	LSL	68,82
				USL	79,18
Remark	TQ 30% hard +/-7% * TQ-Cal.: 200 Nm; Cur-Cal.: 5.744 Nm/A; Speed: 502/50 rpm;				

Char.No.	Char.Descr.	Unit	x_1	x_2	x_3	x_4	x_5	x_6	x_7	x_8	x_9	x_{10}
206285	2K3D	Nm	75,10	74,92	74,96	74,82	74,97	74,94	74,81	75,03	75,04	74,93
206285	2K3D	Grad	28,00	30,00	30,00	30,00	30,00	30,00	30,00	29,00	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}
206285	2K3D	Nm	75,34	74,86	74,93	74,97	75,00	75,08	75,37	75,06	75,00	74,95
206285	2K3D	Grad	30,00	31,00	30,00	31,00	29,00	32,00	30,00	29,00	31,00	29,00

Char.No.	Char.Descr.	Unit	x_{21}	x_{22}	x_{23}	x_{24}	x_{25}	x_{26}	x_{27}	x_{28}	x_{29}	x_{30}
206285	2K3D	Nm	74,98	74,93	74,94	74,85	75,13	75,12	75,00	74,88	75,04	74,85
206285	2K3D	Grad	29,00	29,00	30,00	30,00	32,00	29,00	30,00	30,00	30,00	30,00

Char.No.	Char.Descr.	Unit	x_{31}	x_{32}	x_{33}	x_{34}	x_{35}	x_{36}	x_{37}	x_{38}	x_{39}	x_{40}
206285	2K3D	Nm	75,04	74,91	74,99	75,18	75,21	74,77	75,03	74,84	75,02	75,26
206285	2K3D	Grad	30,00	30,00	31,00	30,00	30,00	30,00	30,00	30,00	29,00	30,00

Char.No.	Char.Descr.	Unit	x_{41}	x_{42}	x_{43}	x_{44}	x_{45}	x_{46}	x_{47}	x_{48}	x_{49}	x_{50}
206285	2K3D	Nm	75,18	75,01	75,01	74,83	75,06	75,09	74,87	75,06	75,25	75,05
206285	2K3D	Grad	31,00	29,00	31,00	30,00	31,00	29,00	30,00	30,00	31,00	29,00

Char.No.	Char.Descr.	Unit	x_{51}	x_{52}	x_{53}	x_{54}	x_{55}	x_{56}	x_{57}	x_{58}	x_{59}	x_{60}
206285	2K3D	Nm	74,99	74,97	75,06	74,97	74,89	75,26	74,85	74,79	75,14	75,12
206285	2K3D	Grad	30,00	30,00	30,00	30,00	30,00	30,00	30,00	29,00	30,00	30,00

Char.No.	Char.Descr.	Unit	x_{61}	x_{62}	x_{63}	x_{64}	x_{65}	x_{66}	x_{67}	x_{68}	x_{69}	x_{70}
206285	2K3D	Nm	74,95	74,95	75,05	75,11	75,16	75,04	74,88	74,80	74,97	74,98
206285	2K3D	Grad	30,00	30,00	31,00	30,00	30,00	30,00	31,00	30,00	30,00	32,00

Char.No.	Char.Descr.	Unit	x_{71}	x_{72}	x_{73}	x_{74}	x_{75}	x_{76}	x_{77}	x_{78}	x_{79}	x_{80}
206285	2K3D	Nm	75,01	75,10	75,26	74,94	74,80	74,98	74,87	74,86	74,91	75,21
206285	2K3D	Grad	30,00	31,00	29,00	30,00	30,00	30,00	30,00	30,00	30,00	30,00

Machine Capability Study
Tool System

Plant	ATG Westhausen		Operator Name	Sünder	Date 29.04.2022

Serial No.	756057_d	Characteristic			
Part type	2BD-2B200A-2K3D-2ZB	Char.Descr.	2K3D	Nom.val.	74,00
Ord. No.	2BD200T1S-A	Serial No.	206285	LSL	68,82
				USL	79,18
Remark	TQ 30% hard +/-7% * TQ-Cal.: 200 Nm; Cur-Cal.: 5.744 Nm/A; Speed: 502/50 rpm;				

Char.No.	Char.Descr.	Unit	x_{81}	x_{82}	x_{83}	x_{84}	x_{85}	x_{86}	x_{87}	x_{88}	x_{89}	x_{90}
206285	2K3D	Nm	75,10	75,00	74,78	74,95	75,02	74,96	75,01	74,92	74,79	74,84
206285	2K3D	Grad	30,00	31,00	30,00	30,00	30,00	30,00	30,00	30,00	31,00	29,00

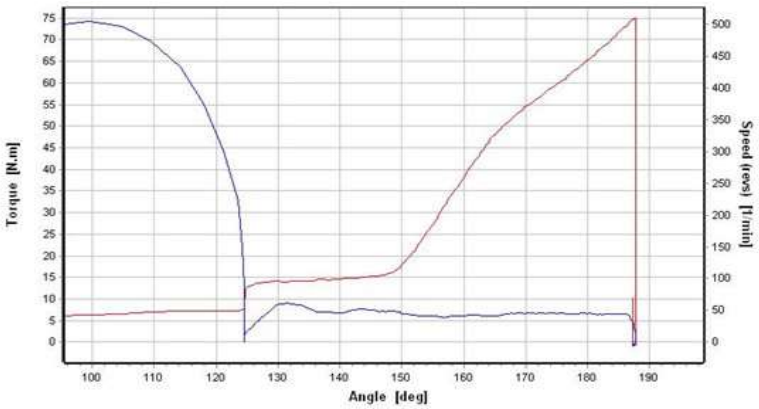
Char.No.	Char.Descr.	Unit	x_{91}	x_{92}	x_{93}	x_{94}	x_{95}	x_{96}	x_{97}	x_{98}	x_{99}	x_{100}
206285	2K3D	Nm	75,19	74,79	75,15	75,09	74,94	75,10	75,01	74,94	74,90	75,09
206285	2K3D	Grad	30,00	32,00	30,00	30,00	30,00	30,00	31,00	30,00	32,00	30,00

Torque graphs

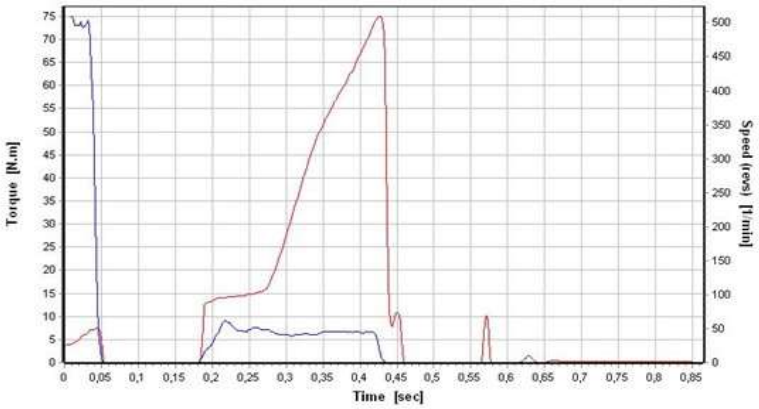
Machine Capability Study 30 %

Model: **2BD-2B200A-2K3D-2ZB**
Serial no: **756057**

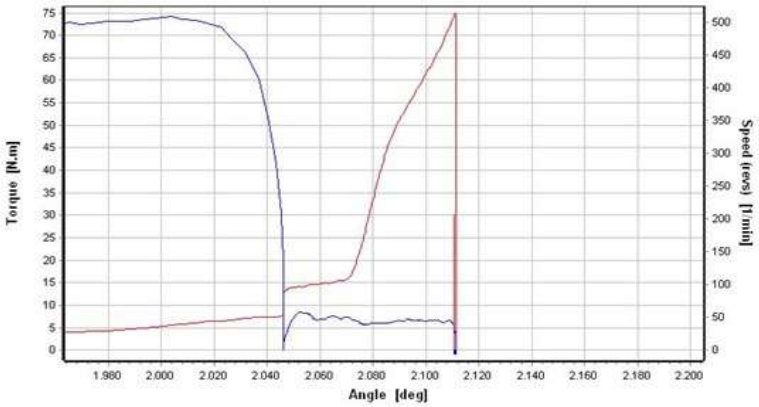
Angle degree: **30°**
Test torque: **74,0 Nm**



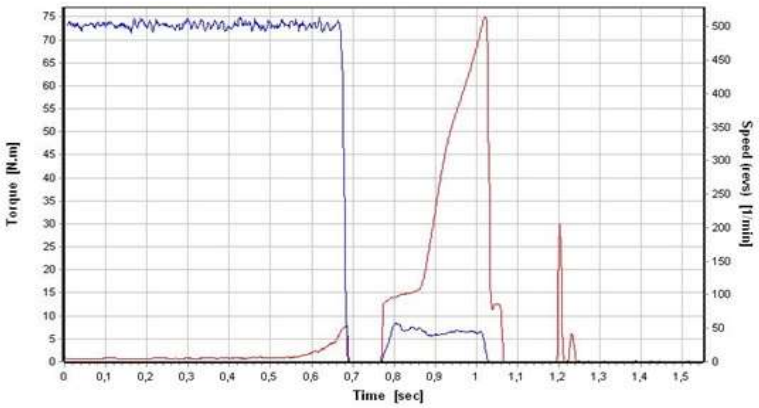
Value no. 1
Graph
Torque / Angle / Speed



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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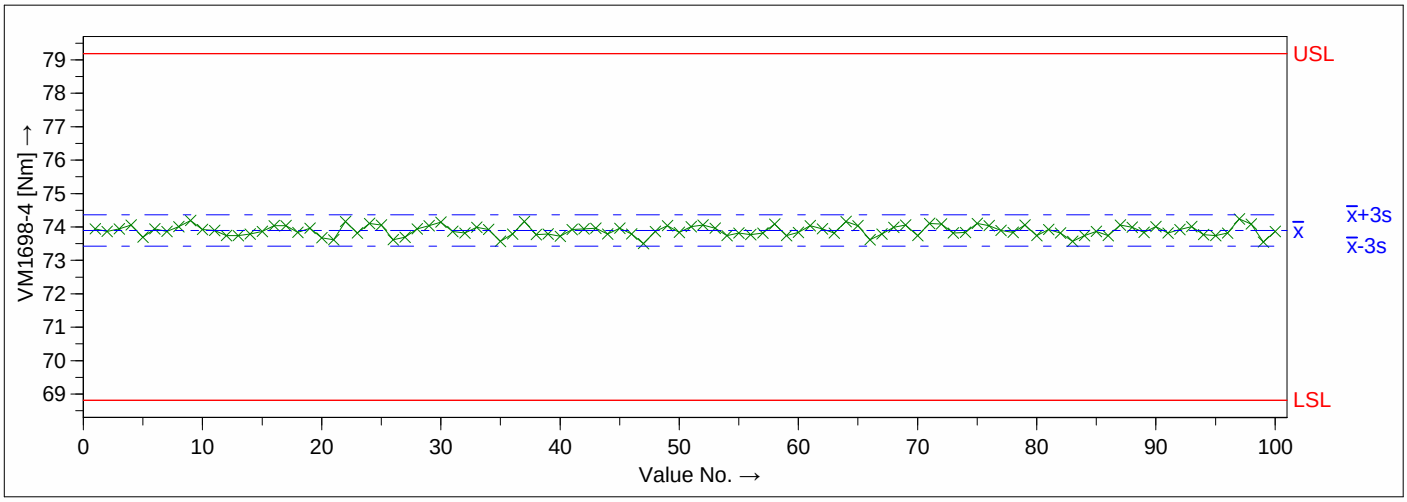
Plant	ATG Westhausen	Operator Name	Sünder
Date	29.04.2022		

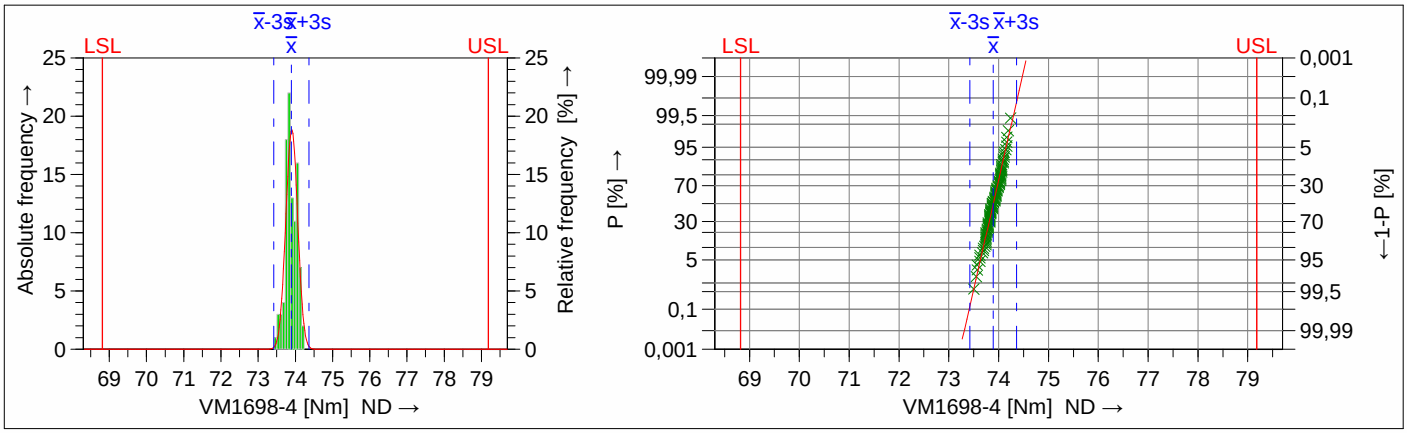
Ord. No.	2BD200T1S-A	Part type	2BD-2B200A-2K3D-2ZB	Contr.item	yes
Serial No.	756057_c	Char.Descr.	VM1698-4	Nom.val. 74,00 5,18	USL 79,18
		Serial No.	1024210	Unit Nm -5,18	LSL 68,82
Char.Type	variable			Tolerance value 7 %	Decimal Pl. 2

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

Evaluation from 29.04.2022 10:26:03 to 29.04.2022 10:42:57

Rem. TQ 30% soft +/-7% * TQ-Cal.: 200 Nm; Cur-Cal.: 5.744 Nm/A; Speed: 502/50 rpm;





Drawing Values		Collected Values		Statistics	
T_m	74.00			x̄	73.8920
LSL	68.82	x_{min}	73.50	x̄-3s	73.4218
USL	79.18	x_{max}	74.24	x̄+3s	74.3622
T	10.36	R	0.74	6s	0.9404
		$n_{<T>}$	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	11.02
Critical capability index	=	C_{mk}	10.79

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 29.04.2022

Serial No.	756057_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.: 5.744 Nm/A; Speed: 502/50 rpm;				

Char.No.	Char.Descr.	Unit	x_1	x_2	x_3	x_4	x_5	x_6	x_7	x_8	x_9	x_{10}
1024210	VM1698-4	Nm	73,94	73,87	73,94	74,06	73,69	73,94	73,87	74,01	74,19	73,92
1024210	VM1698-4	Grad	345,25	345,75	356,75	368,75	318,25	316,50	358,50	316,00	324,50	338,25

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	73,89	73,74	73,74	73,79	73,87	74,04	74,04	73,84	73,96	73,67
1024210	VM1698-4	Grad	331,00	332,50	341,25	326,75	364,25	359,25	324,75	327,50	334,75	350,75

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	73,62	74,16	73,82	74,11	74,06	73,62	73,69	73,94	74,04	74,14
1024210	VM1698-4	Grad	351,50	363,75	318,50	331,50	346,00	332,75	338,50	376,50	355,25	326,00

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	73,87	73,82	73,99	73,92	73,57	73,79	74,16	73,77	73,79	73,72
1024210	VM1698-4	Grad	361,25	345,50	384,25	345,50	345,25	374,25	372,00	342,75	355,25	351,75

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	73,92	73,94	73,96	73,79	73,96	73,79	73,50	73,87	74,04	73,84
1024210	VM1698-4	Grad	388,50	335,00	324,50	334,00	376,00	324,50	341,25	351,00	378,00	332,25

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	74,01	74,06	73,96	73,74	73,82	73,77	73,82	74,09	73,74	73,84
1024210	VM1698-4	Grad	359,25	360,75	382,50	381,25	359,75	369,25	360,25	351,75	345,75	341,50

Char.No.	Char.Descr.	Unit	x_{61}	x_{62}	x_{63}	x_{64}	x_{65}	x_{66}	x_{67}	x_{68}	x_{69}	x_{70}
1024210	VM1698-4	Nm	74,04	73,94	73,82	74,16	74,04	73,62	73,79	73,99	74,06	73,74
1024210	VM1698-4	Grad	384,25	327,00	353,00	385,25	372,75	355,00	349,50	386,25	337,25	353,75

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	74,11	74,09	73,82	73,84	74,11	74,04	73,89	73,84	74,06	73,74
1024210	VM1698-4	Grad	357,25	336,25	370,50	369,75	375,75	349,00	336,00	333,75	335,00	353,00

Machine Capability Study
Control System

Plant	ATG Westhausen		Operator Name	Sünder	Date 29.04.2022

Serial No.	756057_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.: 5.744 Nm/A; Speed: 502/50 rpm;				

Char.No.	Char.Descr.	Unit	x_{81}	x_{82}	x_{83}	x_{84}	x_{85}	x_{86}	x_{87}	x_{88}	x_{89}	x_{90}
1024210	VM1698-4	Nm	73,92	73,82	73,57	73,74	73,87	73,74	74,06	73,99	73,84	74,01
1024210	VM1698-4	Grad	356,75	327,25	367,50	391,00	323,50	368,00	385,00	348,75	356,50	376,50

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	73,82	73,92	74,01	73,77	73,74	73,82	74,24	74,09	73,55	73,87
1024210	VM1698-4	Grad	376,50	353,00	384,75	356,75	333,00	353,75	387,75	325,00	353,75	399,00

Machine Capability Study
Tool System

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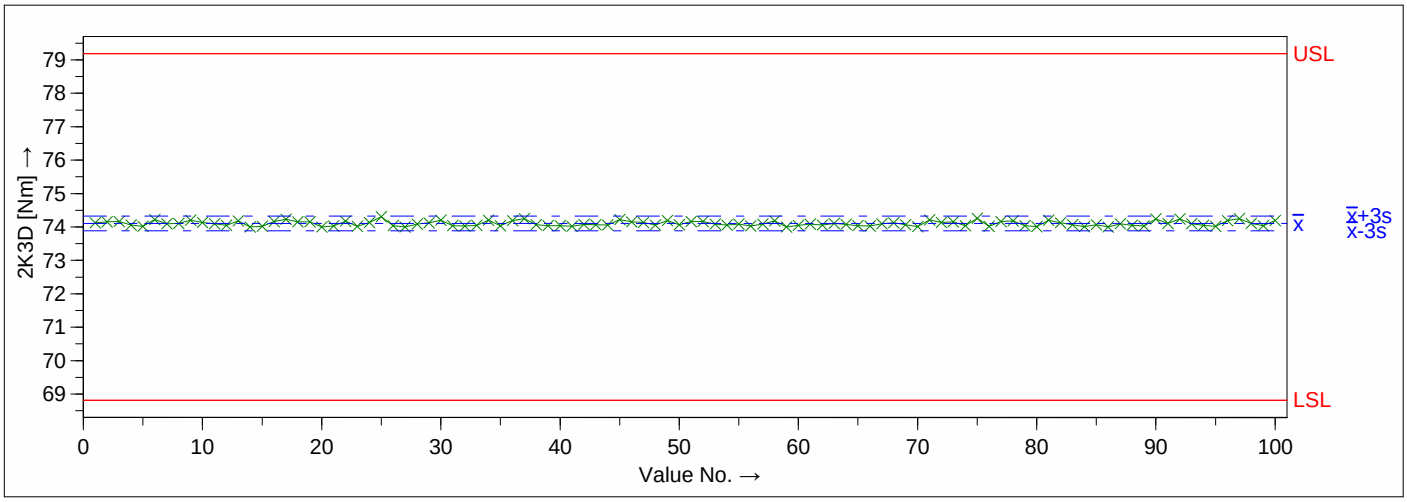
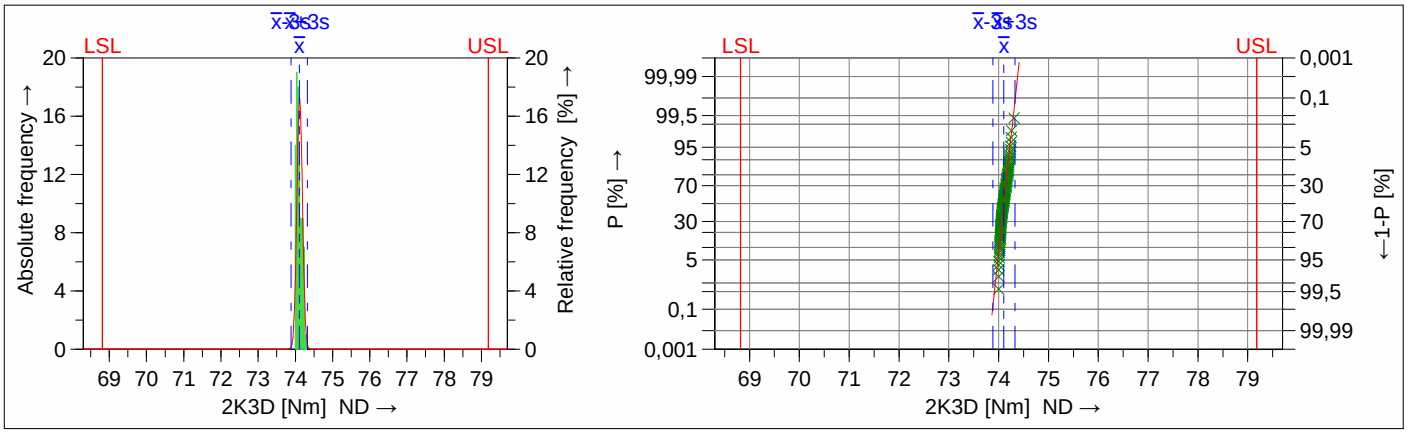
Plant	ATG Westhausen	Operator Name	Sünder
Date	29.04.2022		

Ord. No.	2BD200T1S-A	Part type	2BD-2B200A-2K3D-2ZB	Contr.item	yes
Serial No.	756057_c	Char.Descr.	2K3D	Nom.val. 74,00 5,18	USL 79,18
		Serial No.	206285	Unit Nm -5,18	LSL 68,82
Char.Type	variable			Tolerance value 7 %	Decimal Pl. 2
Cust.Name	Cleco	Reference System	VM1698-4	Test Electronic	MPRO400GCD-P
Contr.No.	Homologation	Reference Transducer	120 / 1019923	nges.	100

Evaluation from 29.04.2022 10:26:05 to 29.04.2022 10:42:58

Rem. TQ 30% soft +/-7% * TQ-Cal.: 200 Nm; Cur-Cal.: 5.744 Nm/A; Speed: 502/50 rpm;





Drawing Values		Collected Values		Statistics	
T_m	74.00			$\bar{x}$	74.1043
LSL	68.82	x_{min}	74.00	$\bar{x}$-3s	73.8829
USL	79.18	x_{max}	74.31	$\bar{x}$+3s	74.3257
T	10.36	R	0.31	6s	0.4428
		$n_{<T>}$	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	23.40
Critical capability index	=	C_{mk}	22.92

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 29.04.2022

Serial No.	756057_c	Characteristic			
Part type	2BD-2B200A-2K3D-2ZB	Char.Descr.	2K3D	Nom.val.	74,00
Ord. No.	2BD200T1S-A	Serial No.	206285	LSL	68,82
				USL	79,18
Remark	TQ 30% soft +/-7% * TQ-Cal.: 200 Nm; Cur-Cal.: 5.744 Nm/A; Speed: 502/50 rpm;				

Char.No.	Char.Descr.	Unit	x_1	x_2	x_3	x_4	x_5	x_6	x_7	x_8	x_9	x_{10}
206285	2K3D	Nm	74,12	74,15	74,16	74,06	74,02	74,22	74,10	74,11	74,20	74,13
206285	2K3D	Grad	346,00	346,00	357,00	368,00	319,00	316,00	362,00	317,00	325,00	339,00

Char.No.	Char.Descr.	Unit	x_{11}	x_{12}	x_{13}	x_{14}	x_{15}	x_{16}	x_{17}	x_{18}	x_{19}	x_{20}
206285	2K3D	Nm	74,10	74,05	74,18	74,00	74,02	74,16	74,23	74,15	74,15	74,00
206285	2K3D	Grad	332,00	334,00	344,00	328,00	366,00	362,00	326,00	329,00	336,00	351,00

Char.No.	Char.Descr.	Unit	x_{21}	x_{22}	x_{23}	x_{24}	x_{25}	x_{26}	x_{27}	x_{28}	x_{29}	x_{30}
206285	2K3D	Nm	74,03	74,17	74,02	74,13	74,31	74,04	74,00	74,09	74,12	74,20
206285	2K3D	Grad	352,00	366,00	320,00	332,00	346,00	334,00	340,00	378,00	355,00	327,00

Char.No.	Char.Descr.	Unit	x_{31}	x_{32}	x_{33}	x_{34}	x_{35}	x_{36}	x_{37}	x_{38}	x_{39}	x_{40}
206285	2K3D	Nm	74,04	74,03	74,05	74,20	74,04	74,19	74,25	74,07	74,04	74,04
206285	2K3D	Grad	362,00	346,00	389,00	345,00	347,00	378,00	377,00	345,00	355,00	352,00

Char.No.	Char.Descr.	Unit	x_{41}	x_{42}	x_{43}	x_{44}	x_{45}	x_{46}	x_{47}	x_{48}	x_{49}	x_{50}
206285	2K3D	Nm	74,02	74,08	74,07	74,06	74,22	74,15	74,13	74,06	74,19	74,07
206285	2K3D	Grad	389,00	336,00	325,00	335,00	379,00	327,00	343,00	351,00	378,00	334,00

Char.No.	Char.Descr.	Unit	x_{51}	x_{52}	x_{53}	x_{54}	x_{55}	x_{56}	x_{57}	x_{58}	x_{59}	x_{60}
206285	2K3D	Nm	74,16	74,16	74,09	74,06	74,09	74,03	74,09	74,18	74,00	74,05
206285	2K3D	Grad	359,00	362,00	384,00	386,00	361,00	371,00	361,00	352,00	347,00	342,00

Char.No.	Char.Descr.	Unit	x_{61}	x_{62}	x_{63}	x_{64}	x_{65}	x_{66}	x_{67}	x_{68}	x_{69}	x_{70}
206285	2K3D	Nm	74,09	74,06	74,11	74,08	74,04	74,03	74,10	74,12	74,07	74,01
206285	2K3D	Grad	385,00	328,00	355,00	386,00	373,00	357,00	351,00	392,00	339,00	354,00

Char.No.	Char.Descr.	Unit	x_{71}	x_{72}	x_{73}	x_{74}	x_{75}	x_{76}	x_{77}	x_{78}	x_{79}	x_{80}
206285	2K3D	Nm	74,21	74,13	74,15	74,04	74,26	74,02	74,16	74,18	74,04	74,01
206285	2K3D	Grad	358,00	337,00	372,00	371,00	378,00	349,00	336,00	334,00	334,00	354,00

Machine Capability Study
Tool System

Plant	ATG Westhausen		Operator Name	Sünder	Date 29.04.2022

Serial No.	756057_c	Characteristic			
Part type	2BD-2B200A-2K3D-2ZB	Char.Descr.	2K3D	Nom.val.	74,00
Ord. No.	2BD200T1S-A	Serial No.	206285	LSL	68,82
				USL	79,18
Remark	TQ 30% soft +/-7% * TQ-Cal.: 200 Nm; Cur-Cal.: 5.744 Nm/A; Speed: 502/50 rpm;				

Char.No.	Char.Descr.	Unit	x_{81}	x_{82}	x_{83}	x_{84}	x_{85}	x_{86}	x_{87}	x_{88}	x_{89}	x_{90}
206285	2K3D	Nm	74,20	74,12	74,07	74,01	74,07	74,00	74,10	74,05	74,03	74,24
206285	2K3D	Grad	358,00	330,00	369,00	393,00	325,00	368,00	387,00	350,00	358,00	378,00

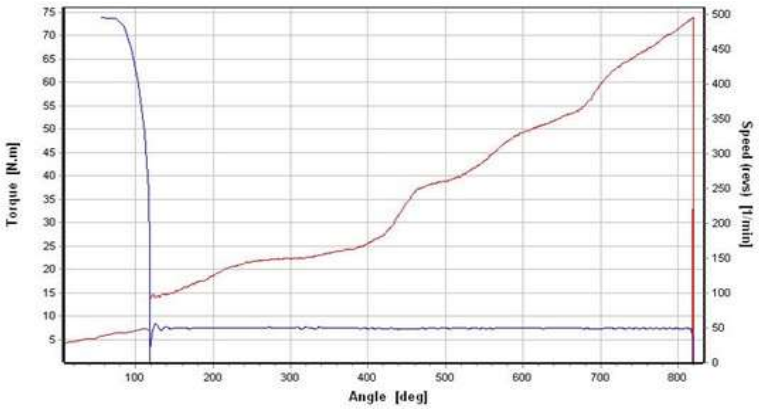
Char.No.	Char.Descr.	Unit	x_{91}	x_{92}	x_{93}	x_{94}	x_{95}	x_{96}	x_{97}	x_{98}	x_{99}	x_{100}
206285	2K3D	Nm	74,11	74,24	74,10	74,05	74,02	74,19	74,25	74,11	74,04	74,19
206285	2K3D	Grad	379,00	354,00	385,00	359,00	335,00	355,00	388,00	326,00	356,00	402,00

Torque graphs

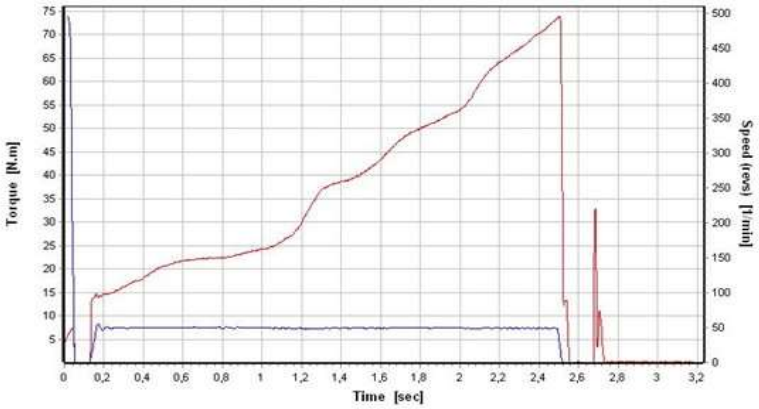
Machine Capability Study 30 %

Model: **2BD-2B200A-2K3D-2ZB**
Serial no: **756057**

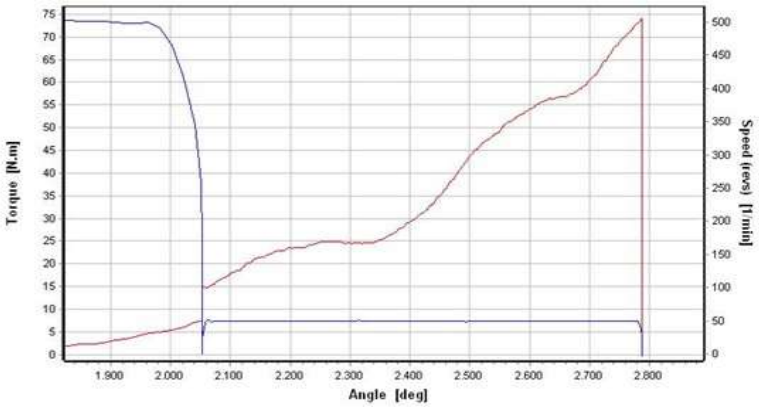
Angle degree: **360°**
Test torque: **74,0 Nm**



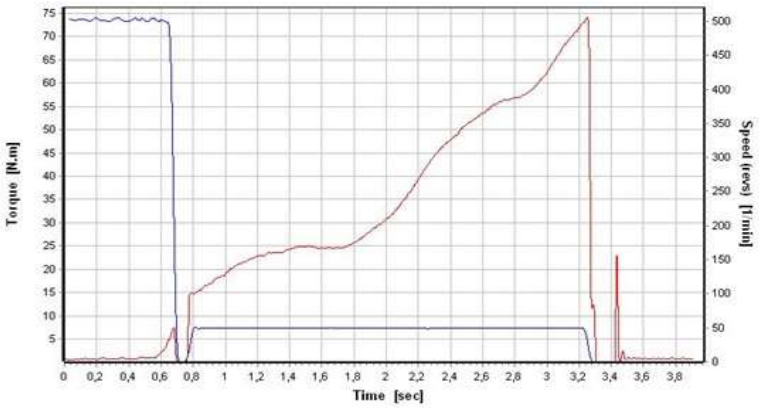
Value no. 1
Graph
Torque / Angle / Speed



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: **756057**

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

Hard joint (H)	999,06	Nm / Revolution	Angle degree	30°
Soft joint (L)	82,47	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	166,51	164,93 Nm
	Standard deviation	0,24	0,19 Nm
	Torque scatter (99,73%)	1,44	1,15 Nm
	C_m	15,90	19,89
	C_{mk}	12,42	18,28

b)	Min. C_m hard/soft (lowest value)	15,90
	Min. C_{mk} hard/soft (lowest value)	12,42

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

Note:

Machine Capability Study
Control System

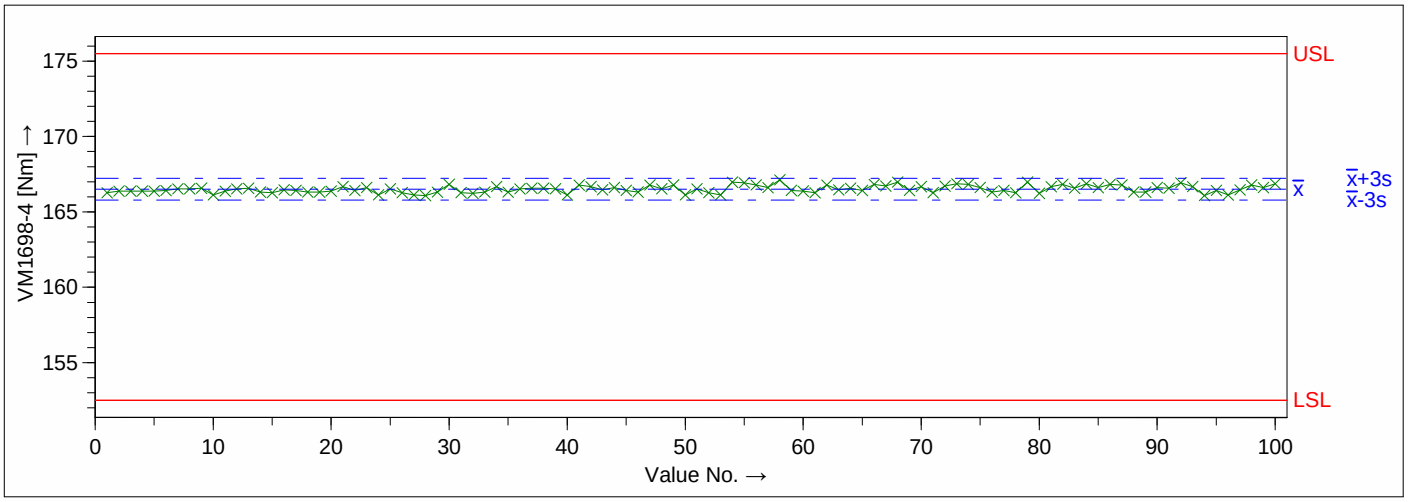
Cleco Production Tools

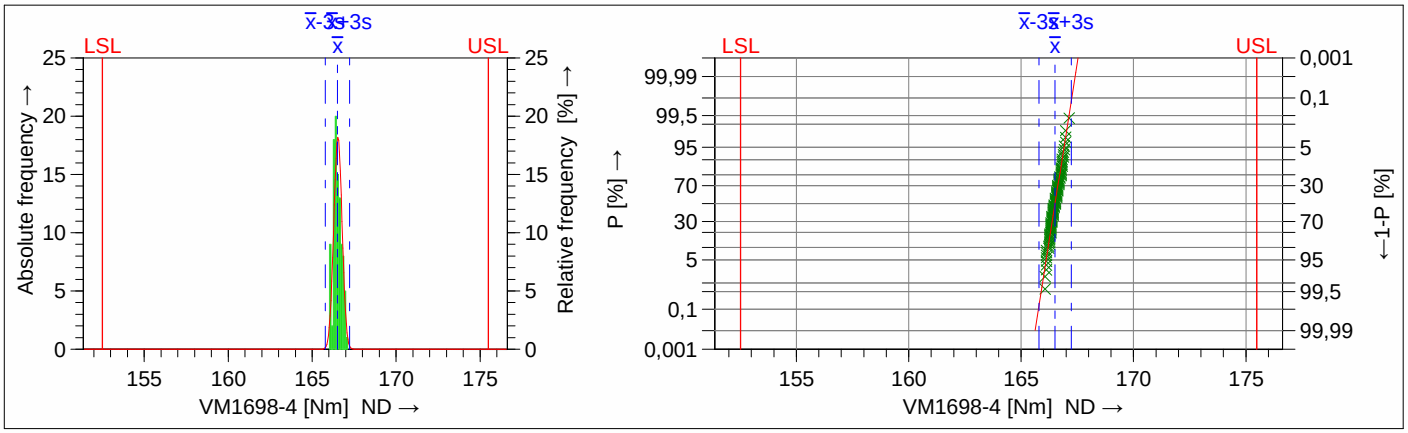
Plant	ATG Westhausen	Operator Name	Sünder
Date	29.04.2022		

Ord. No.	2BD200T1S-A	Part type	2BD-2B200A-2K3D-2ZB	Contr.item	yes
Serial No.	756057_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 29.04.2022 07:48:50 to 29.04.2022 08:03:44

Rem. TQ 80% hard +/-7% * TQ-Cal.: 200 Nm; Cur-Cal.: 5.751 Nm/A; Speed: 502/50 rpm;





Drawing Values		Collected Values		Statistics	
T_m	164.00			$\bar{x}$	166.5099
LSL	152.52	x_{min}	166.07	$\bar{x}$-3s	165.7877
USL	175.48	x_{max}	167.13	$\bar{x}$+3s	167.2321
T	22.96	R	1.06	6s	1.4443
		$n_{<T>}$	100	$p_{<T>}$	100.00000 %
		$n_{>USL}$	0	$p_{>USL}$	0.00000%
		$n_{<LSL}$	0	$p_{<LSL}$	0.00000%
		n_{eff}	100		
		n_{tot}	100		

Model distribution			Normal Distribution
Calculation method			M1 1.4 $\hat{\sigma}$ = S_{tot}
Potential Capability index	=	C_m	15.90
Critical capability index	=	C_{mk}	12.42

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 29.04.2022

Serial No.	756057_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.: 5.751 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	166,27	166,37	166,37	166,37	166,37	166,42	166,52	166,52	166,57	166,12
1024210	VM1698-4	Grad	29,50	29,00	28,50	29,25	30,00	27,75	28,00	27,75	27,75	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	166,37	166,52	166,57	166,32	166,27	166,47	166,42	166,32	166,32	166,37
1024210	VM1698-4	Grad	30,00	29,00	28,75	28,00	30,00	30,50	30,25	30,00	28,25	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	166,67	166,42	166,62	166,12	166,52	166,27	166,12	166,07	166,32	166,82
1024210	VM1698-4	Grad	30,75	30,00	29,75	30,00	29,50	29,75	30,25	30,00	29,25	27,25

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	166,27	166,22	166,32	166,67	166,32	166,52	166,57	166,57	166,52	166,12
1024210	VM1698-4	Grad	30,00	30,25	27,75	31,25	30,00	30,25	30,75	30,25	29,50	29,25

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	166,77	166,67	166,47	166,62	166,42	166,32	166,77	166,52	166,77	166,12
1024210	VM1698-4	Grad	27,75	28,00	31,50	30,50	30,25	28,00	28,25	31,25	29,75	30,75

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	166,52	166,27	166,12	166,98	166,92	166,77	166,62	167,13	166,42	166,37
1024210	VM1698-4	Grad	28,25	28,25	31,25	30,25	31,25	30,75	29,50	29,75	29,00	29,75

Char.No.	Char.Descr.	Unit	x_{61}	x_{62}	x_{63}	x_{64}	x_{65}	x_{66}	x_{67}	x_{68}	x_{69}	x_{70}
1024210	VM1698-4	Nm	166,27	166,77	166,47	166,57	166,42	166,82	166,72	166,98	166,42	166,67
1024210	VM1698-4	Grad	30,75	30,75	30,75	30,00	30,25	30,25	29,00	29,50	29,75	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	166,27	166,72	166,87	166,82	166,62	166,32	166,42	166,27	166,98	166,22
1024210	VM1698-4	Grad	29,25	29,50	29,75	29,25	29,50	29,75	30,25	30,00	28,50	31,25

Machine Capability Study
Control System

Plant	ATG Westhausen		Operator Name	Sünder	Date 29.04.2022

Serial No.	756057_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.: 5.751 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	166,67	166,82	166,57	166,87	166,62	166,82	166,77	166,32	166,32	166,62
1024210	VM1698-4	Grad	29,75	30,00	29,50	29,75	29,25	29,75	30,00	29,50	29,25	30,00

Char.No.	Char.Descr.	Unit	x_{91}	x_{92}	x_{93}	x_{94}	x_{95}	x_{96}	x_{97}	x_{98}	x_{99}	x_{100}
1024210	VM1698-4	Nm	166,57	166,92	166,67	166,07	166,42	166,12	166,47	166,77	166,62	166,87
1024210	VM1698-4	Grad	30,25	30,00	31,25	30,50	30,50	29,75	29,25	30,75	31,00	29,50

Machine Capability Study
Tool System

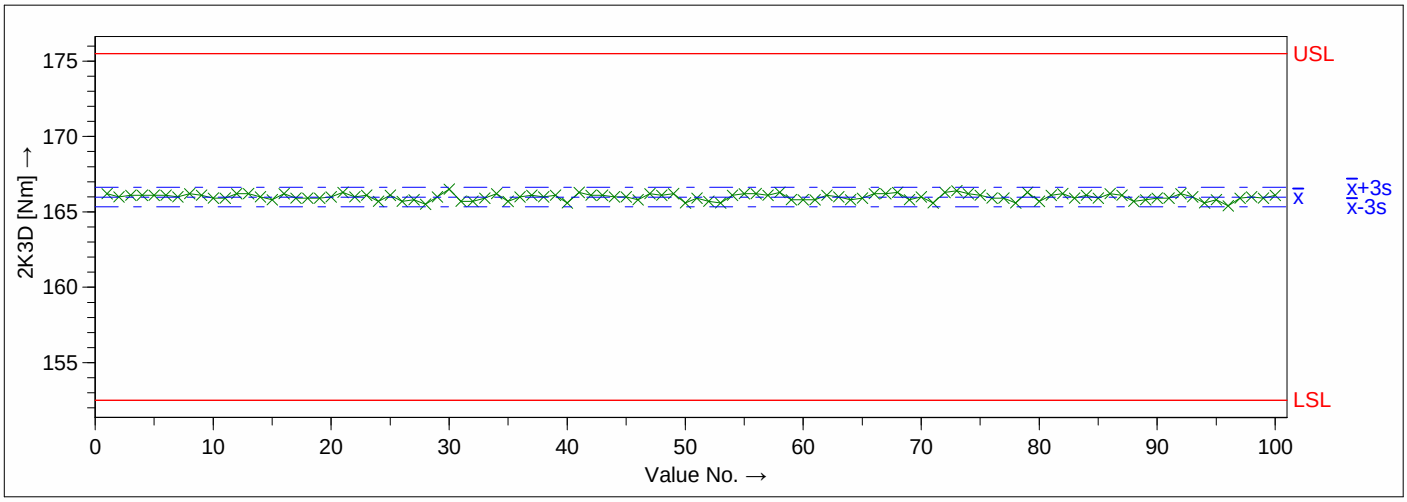
Cleco Production Tools

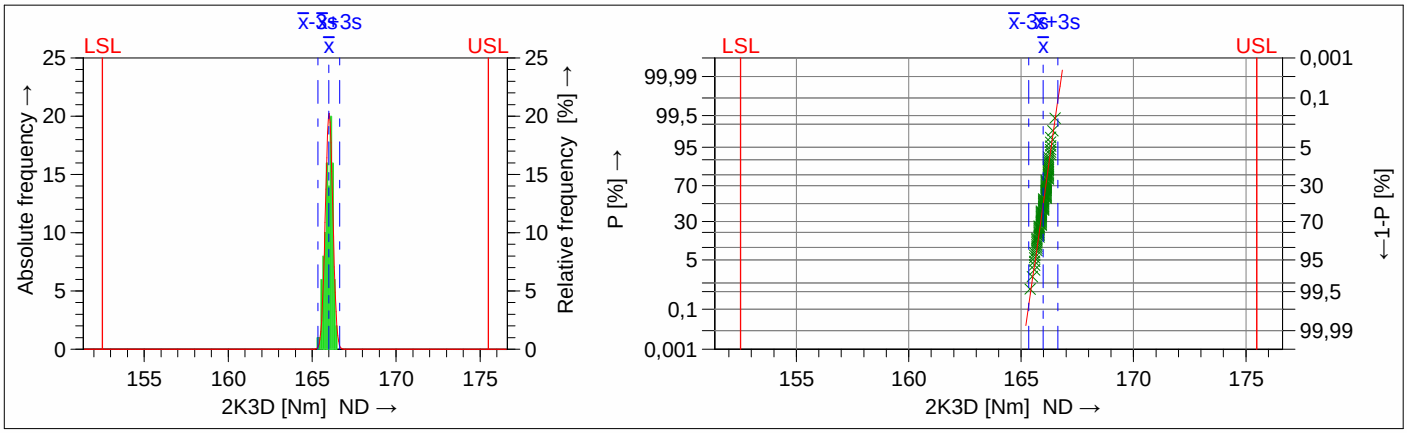
Plant	ATG Westhausen	Operator Name	Sünder
Date	29.04.2022		

Ord. No.	2BD200T1S-A	Part type	2BD-2B200A-2K3D-2ZB	Contr.item	yes
Serial No.	756057_h	Char.Descr.	2K3D	Nom.val. 164,00	11,48 USL 175,48
		Serial No.	206285	Unit Nm	-11,48 LSL 152,52
Char.Type	variable			Tolerance value 7 %	Decimal Pl. 2
Cust.Name	Cleco	Reference System	VM1698-4	Test Electronic	MPRO400GCD-P
Contr.No.	Homologation	Reference Transducer	250 / 5537037	nges.	100

Evaluation from 29.04.2022 07:48:51 to 29.04.2022 08:03:45

Rem. TQ 80% hard +/-7% * TQ-Cal.: 200 Nm; Cur-Cal.: 5.751 Nm/A; Speed: 502/50 rpm;





Drawing Values		Collected Values		Statistics	
T_m	164.00			$\bar{x}$	165.9840
LSL	152.52	x_{min}	165.40	$\bar{x}$-3s	165.3363
USL	175.48	x_{max}	166.50	$\bar{x}$+3s	166.6317
T	22.96	R	1.10	6s	1.2954
		$n_{<T>}$	100	$p_{<T>}$	100.00000 %
		$n_{>USL}$	0	$p_{>USL}$	0.00000%
		$n_{<LSL}$	0	$p_{<LSL}$	0.00000%
		n_{eff}	100		
		n_{tot}	100		

Model distribution		Normal Distribution	
Calculation method		M1 1.4 $\hat{\sigma}$ = S_{tot}	
Potential Capability index	=	C_m	17.72
Critical capability index	=	C_{mk}	14.66

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 29.04.2022

Serial No.	756057_h	Characteristic			
Part type	2BD-2B200A-2K3D-2ZB	Char.Descr.	2K3D	Nom.val.	164,00
Ord. No.	2BD200T1S-A	Serial No.	206285	LSL	152,52
				USL	175,48
Remark	TQ 80% hard +/-7% * TQ-Cal.: 200 Nm; Cur-Cal.: 5.751 Nm/A; Speed: 502/50 rpm;				

Char.No.	Char.Descr.	Unit	x_1	x_2	x_3	x_4	x_5	x_6	x_7	x_8	x_9	x_{10}
206285	2K3D	Nm	166,20	166,00	166,10	166,10	166,10	166,10	166,00	166,20	166,10	165,90
206285	2K3D	Grad	30,00	30,00	29,00	30,00	31,00	29,00	29,00	28,00	28,00	31,00

Char.No.	Char.Descr.	Unit	x_{11}	x_{12}	x_{13}	x_{14}	x_{15}	x_{16}	x_{17}	x_{18}	x_{19}	x_{20}
206285	2K3D	Nm	165,90	166,20	166,20	166,00	165,80	166,20	165,90	165,90	165,90	166,00
206285	2K3D	Grad	31,00	30,00	30,00	29,00	31,00	31,00	31,00	31,00	29,00	31,00

Char.No.	Char.Descr.	Unit	x_{21}	x_{22}	x_{23}	x_{24}	x_{25}	x_{26}	x_{27}	x_{28}	x_{29}	x_{30}
206285	2K3D	Nm	166,30	166,00	166,10	165,70	166,10	165,70	165,80	165,50	166,00	166,50
206285	2K3D	Grad	31,00	31,00	31,00	31,00	30,00	30,00	31,00	30,00	30,00	28,00

Char.No.	Char.Descr.	Unit	x_{31}	x_{32}	x_{33}	x_{34}	x_{35}	x_{36}	x_{37}	x_{38}	x_{39}	x_{40}
206285	2K3D	Nm	165,70	165,70	165,90	166,20	165,70	166,00	166,10	166,00	166,10	165,60
206285	2K3D	Grad	31,00	31,00	29,00	32,00	31,00	31,00	31,00	31,00	30,00	30,00

Char.No.	Char.Descr.	Unit	x_{41}	x_{42}	x_{43}	x_{44}	x_{45}	x_{46}	x_{47}	x_{48}	x_{49}	x_{50}
206285	2K3D	Nm	166,30	166,10	166,10	166,00	166,00	165,80	166,20	166,10	166,20	165,60
206285	2K3D	Grad	28,00	29,00	32,00	31,00	31,00	29,00	29,00	32,00	31,00	31,00

Char.No.	Char.Descr.	Unit	x_{51}	x_{52}	x_{53}	x_{54}	x_{55}	x_{56}	x_{57}	x_{58}	x_{59}	x_{60}
206285	2K3D	Nm	165,90	165,70	165,60	166,10	166,20	166,20	166,10	166,30	165,80	165,80
206285	2K3D	Grad	29,00	29,00	32,00	31,00	32,00	32,00	31,00	30,00	30,00	31,00

Char.No.	Char.Descr.	Unit	x_{61}	x_{62}	x_{63}	x_{64}	x_{65}	x_{66}	x_{67}	x_{68}	x_{69}	x_{70}
206285	2K3D	Nm	165,80	166,10	166,00	165,80	165,90	166,20	166,20	166,30	165,80	166,00
206285	2K3D	Grad	32,00	32,00	31,00	31,00	31,00	31,00	30,00	31,00	30,00	30,00

Char.No.	Char.Descr.	Unit	x_{71}	x_{72}	x_{73}	x_{74}	x_{75}	x_{76}	x_{77}	x_{78}	x_{79}	x_{80}
206285	2K3D	Nm	165,60	166,30	166,40	166,20	166,10	165,90	165,90	165,60	166,30	165,70
206285	2K3D	Grad	30,00	30,00	31,00	30,00	30,00	31,00	31,00	32,00	29,00	32,00

Machine Capability Study
Tool System

Plant	ATG Westhausen		Operator Name	Sünder	Date 29.04.2022

Serial No.	756057_h	Characteristic			
Part type	2BD-2B200A-2K3D-2ZB	Char.Descr.	2K3D	Nom.val.	164,00
Ord. No.	2BD200T1S-A	Serial No.	206285	LSL	152,52
				USL	175,48
Remark	TQ 80% hard +/-7% * TQ-Cal.: 200 Nm; Cur-Cal.: 5.751 Nm/A; Speed: 502/50 rpm;				

Char.No.	Char.Descr.	Unit	x_{81}	x_{82}	x_{83}	x_{84}	x_{85}	x_{86}	x_{87}	x_{88}	x_{89}	x_{90}
206285	2K3D	Nm	166,10	166,20	165,90	166,10	165,90	166,20	166,10	165,70	165,80	165,90
206285	2K3D	Grad	31,00	31,00	31,00	30,00	30,00	30,00	31,00	30,00	31,00	31,00

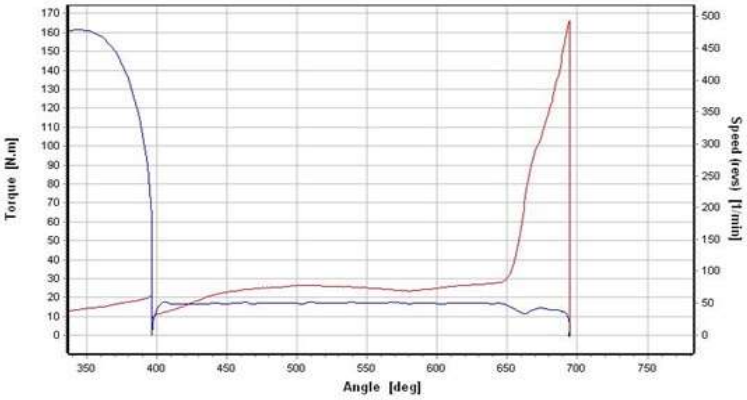
Char.No.	Char.Descr.	Unit	x_{91}	x_{92}	x_{93}	x_{94}	x_{95}	x_{96}	x_{97}	x_{98}	x_{99}	x_{100}
206285	2K3D	Nm	165,90	166,20	166,00	165,60	165,80	165,40	165,90	166,00	165,90	166,10
206285	2K3D	Grad	31,00	31,00	32,00	32,00	31,00	31,00	30,00	32,00	32,00	31,00

Torque graphs

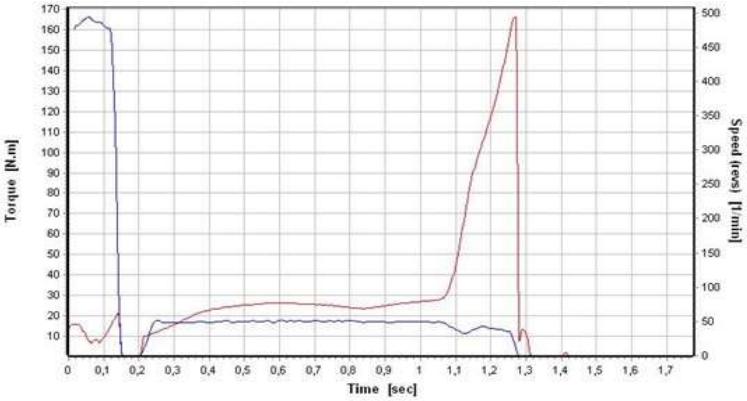
Machine Capability Study 80 %

Model: **2BD-2B200A-2K3D-2ZB**
Serial no: **756057**

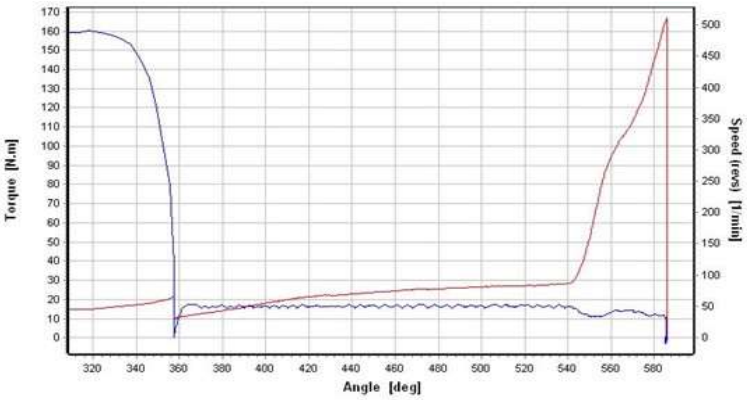
Angle degree: **30°**
Test torque: **164,0 Nm**



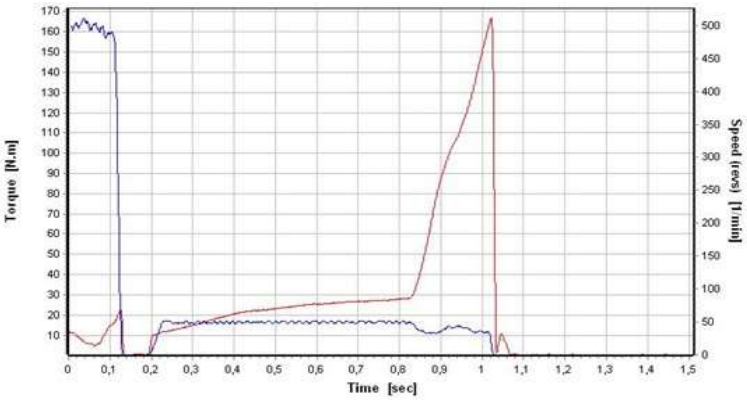
Value no. 1
Graph
Torque / Angle / Speed



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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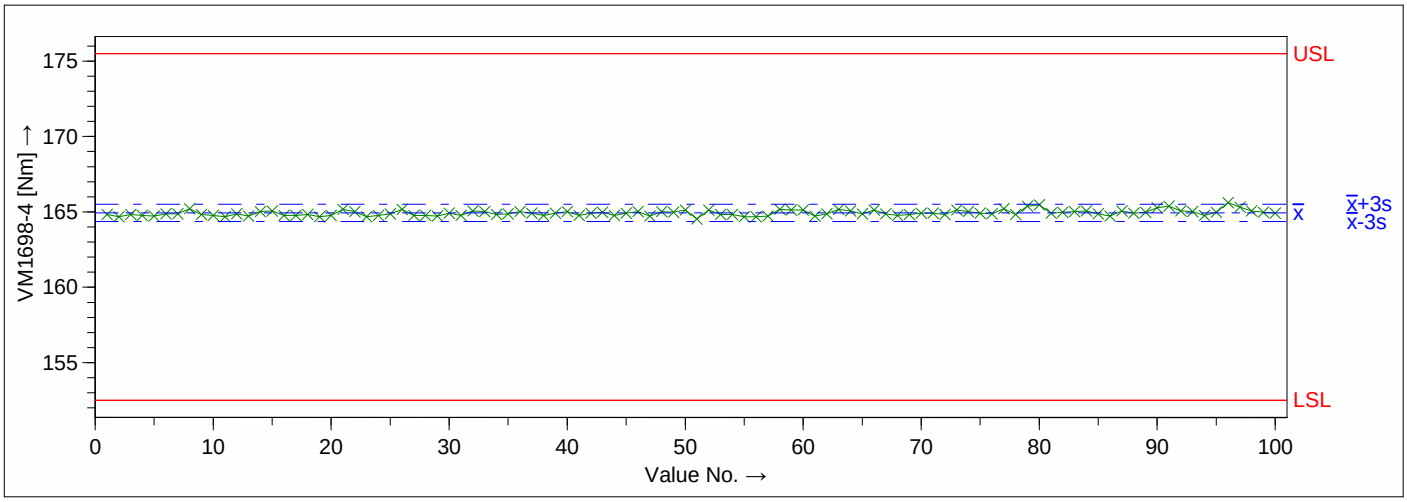
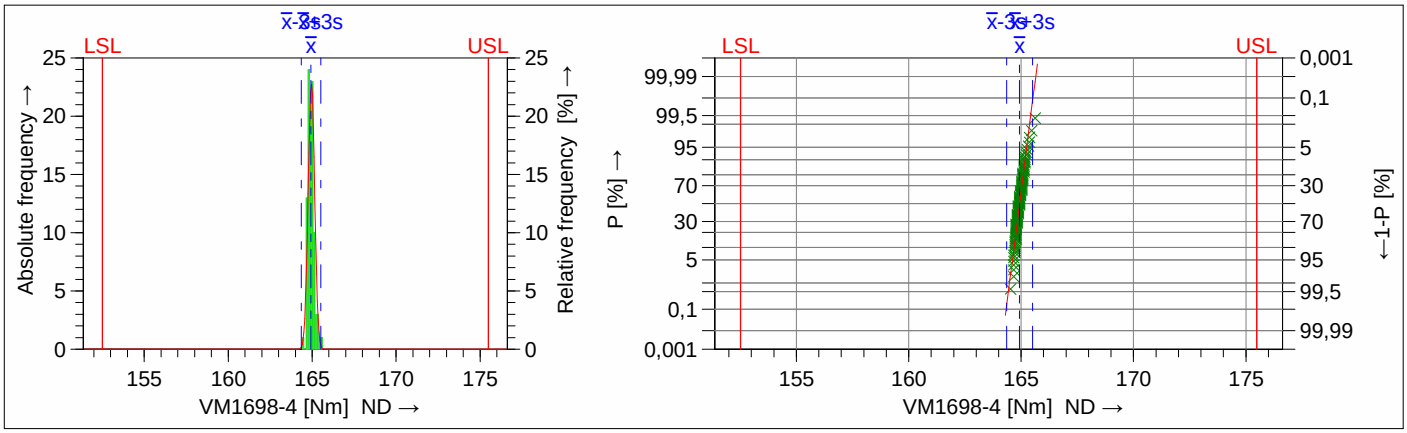
Plant	ATG Westhausen	Operator Name	Sünder
Date	29.04.2022		

Ord. No.	2BD200T1S-A	Part type	2BD-2B200A-2K3D-2ZB	Contr.item	yes
Serial No.	756057_g	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 29.04.2022 08:09:50 to 29.04.2022 09:09:45

Rem. TQ 80% soft +/-7% * TQ-Cal.: 200 Nm; Cur-Cal.: 5.751 Nm/A; Speed: 502/50 rpm;





Drawing Values		Collected Values		Statistics	
T_m	164.00			$\bar{x}$	164.9315
LSL	152.52	x_{min}	164.52	$\bar{x}$-3s	164.3543
USL	175.48	x_{max}	165.62	$\bar{x}$+3s	165.5087
T	22.96	R	1.10	6s	1.1543
		$n_{<T>}$	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	19.89
Critical capability index	=	C_{mk}	18.28

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 29.04.2022

Serial No.	756057_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.: 5.751 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	164,67	164,82	164,77	164,72	164,87	164,87	165,22	164,82	164,77
1024210	VM1698-4	Grad	354,75	349,50	357,50	354,50	356,25	357,50	349,25	363,75	352,75	353,00

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	164,67	164,87	164,72	165,02	165,07	164,77	164,77	164,82	164,67	164,77
1024210	VM1698-4	Grad	357,75	353,25	349,25	355,25	349,75	353,75	357,75	358,25	359,50	365,75

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	165,17	165,02	164,67	164,77	164,87	165,17	164,77	164,77	164,72	164,92
1024210	VM1698-4	Grad	359,00	363,00	353,50	355,00	357,50	353,50	350,25	354,75	354,75	355,25

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	164,77	165,07	165,02	164,82	164,87	165,02	164,92	164,77	164,92	165,02
1024210	VM1698-4	Grad	348,75	353,00	353,25	352,00	357,50	351,75	360,75	356,25	363,75	351,00

Char.No.	Char.Descr.	Unit	x_{41}	x_{42}	x_{43}	x_{44}	x_{45}	x_{46}	x_{47}	x_{48}	x_{49}	x_{50}
1024210	VM1698-4	Nm	164,77	164,92	164,97	164,77	164,92	165,02	164,72	165,02	164,97	165,12
1024210	VM1698-4	Grad	352,00	347,25	358,50	352,00	359,25	351,25	355,00	362,75	369,00	350,75

Char.No.	Char.Descr.	Unit	x_{51}	x_{52}	x_{53}	x_{54}	x_{55}	x_{56}	x_{57}	x_{58}	x_{59}	x_{60}
1024210	VM1698-4	Nm	164,52	165,12	164,82	164,82	164,67	164,67	164,72	165,17	165,12	165,12
1024210	VM1698-4	Grad	362,50	353,50	344,50	354,25	349,75	352,25	355,00	355,25	353,75	352,25

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	164,72	164,87	165,17	165,07	164,87	165,12	164,87	164,77	164,82	164,92
1024210	VM1698-4	Grad	346,75	355,25	357,50	352,75	360,75	350,25	357,25	361,75	355,75	352,00

Char.No.	Char.Descr.	Unit	x_{71}	x_{72}	x_{73}	x_{74}	x_{75}	x_{76}	x_{77}	x_{78}	x_{79}	x_{80}
1024210	VM1698-4	Nm	164,92	164,82	165,12	165,02	164,92	164,87	165,22	164,82	165,37	165,47
1024210	VM1698-4	Grad	362,75	349,75	358,75	359,25	365,00	348,75	356,25	371,75	360,75	352,75

Machine Capability Study
Control System

Plant	ATG Westhausen		Operator Name	Sünder	Date 29.04.2022

Serial No.	756057_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.: 5.751 Nm/A; Speed: 502/50 rpm;				

Char.No.	Char.Descr.	Unit	x_{81}	x_{82}	x_{83}	x_{84}	x_{85}	x_{86}	x_{87}	x_{88}	x_{89}	x_{90}
1024210	VM1698-4	Nm	164,92	164,97	165,02	165,07	164,87	164,72	165,07	164,92	164,97	165,27
1024210	VM1698-4	Grad	355,50	366,25	357,75	367,50	354,00	360,00	363,75	358,75	366,75	359,25

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	165,37	165,07	165,02	164,77	164,97	165,62	165,32	165,07	164,97	164,92
1024210	VM1698-4	Grad	358,25	353,00	360,50	349,75	354,75	358,75	356,75	370,25	362,50	357,25

Machine Capability Study
Tool System

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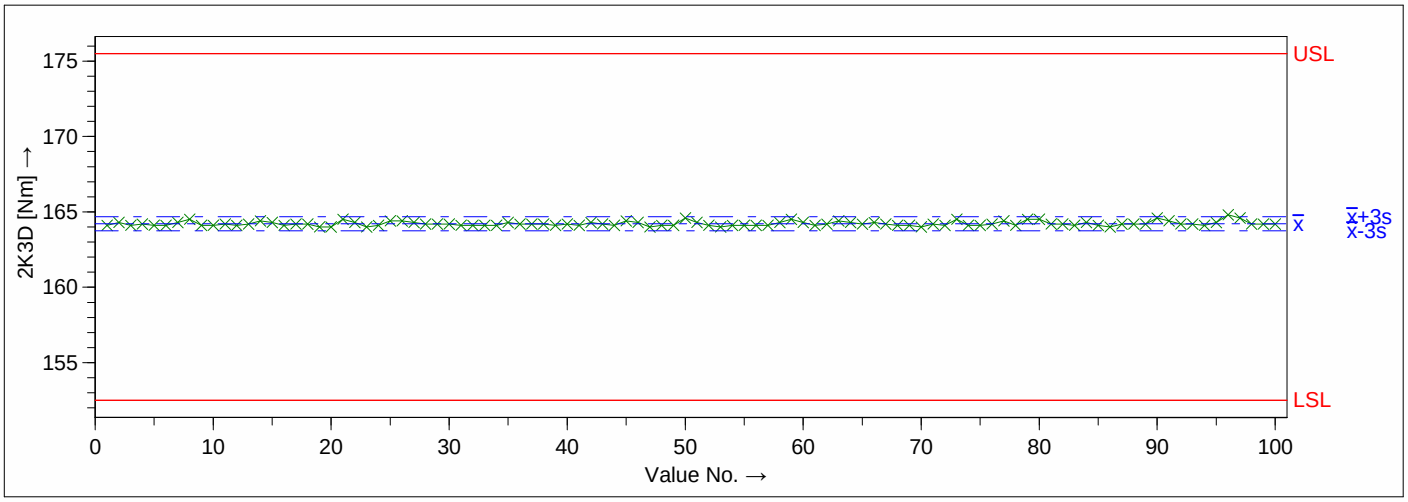
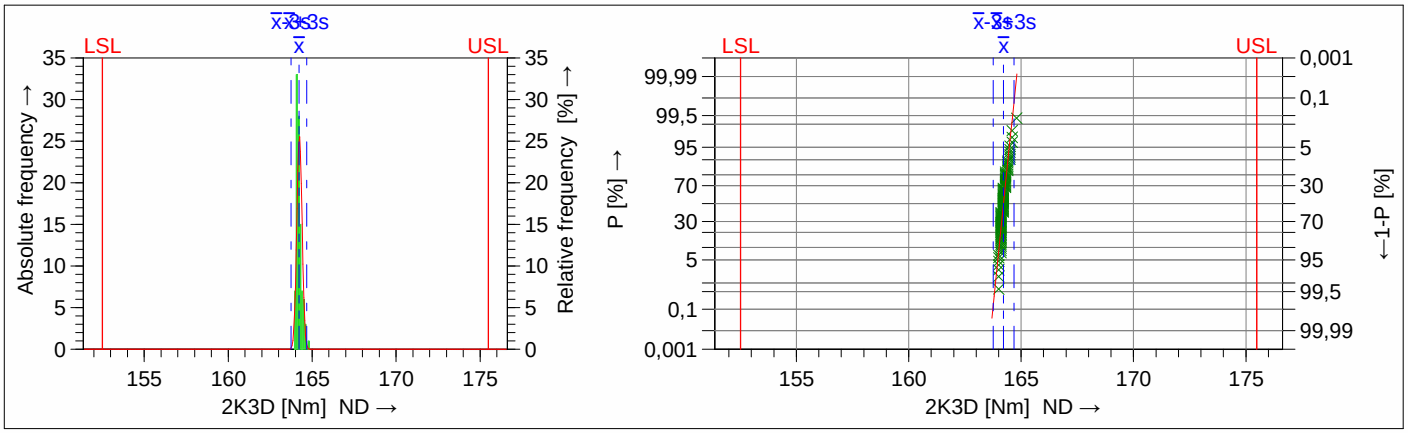
Plant	ATG Westhausen	Operator Name	Sünder
Date	29.04.2022		

Ord. No.	2BD200T1S-A	Part type	2BD-2B200A-2K3D-2ZB	Contr.item	yes
Serial No.	756057_g	Char.Descr.	2K3D	Nom.val. 164,00 11,48	USL 175,48
		Serial No.	206285	Unit Nm -11,48	LSL 152,52
Char.Type	variable			Tolerance value 7 %	Decimal Pl. 2
Cust.Name	Cleco	Reference System	VM1698-4	Test Electronic	MPRO400GCD-P
Contr.No.	Homologation	Reference Transducer	250 / 5537037	nges.	100

Evaluation from 29.04.2022 08:09:52 to 29.04.2022 09:09:46

Rem. TQ 80% soft +/-7% * TQ-Cal.: 200 Nm; Cur-Cal.: 5.751 Nm/A; Speed: 502/50 rpm;





Drawing Values		Collected Values		Statistics	
T_m	164.00			$\bar{x}$	164.2180
LSL	152.52	x_{min}	164.00	$\bar{x}$-3s	163.7521
USL	175.48	x_{max}	164.80	$\bar{x}$+3s	164.6839
T	22.96	R	0.80	6s	0.9318
		$n_{<T>}$	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	24.64
Critical capability index	=	C_{mk}	24.17

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

APEX VDI/VDE 2647 V0.1

Apex Tool Group GmbH \\htwe0006\Appdata\QW\QWE\Messwert\2022\756057_g1.DFD

Machine Capability Study
Tool System

Plant	ATG Westhausen		Operator Name	Sünder	Date 29.04.2022

Serial No.	756057_g	Characteristic			
Part type	2BD-2B200A-2K3D-2ZB	Char.Descr.	2K3D	Nom.val.	164,00
Ord. No.	2BD200T1S-A	Serial No.	206285	LSL	152,52
				USL	175,48
Remark	TQ 80% soft +/-7% * TQ-Cal.: 200 Nm; Cur-Cal.: 5.751 Nm/A; Speed: 502/50 rpm;				

Char.No.	Char.Descr.	Unit	x_1	x_2	x_3	x_4	x_5	x_6	x_7	x_8	x_9	x_{10}
206285	2K3D	Nm	164,10	164,30	164,10	164,20	164,10	164,10	164,30	164,50	164,10	164,10
206285	2K3D	Grad	355,00	349,00	357,00	355,00	355,00	357,00	349,00	363,00	351,00	352,00

Char.No.	Char.Descr.	Unit	x_{11}	x_{12}	x_{13}	x_{14}	x_{15}	x_{16}	x_{17}	x_{18}	x_{19}	x_{20}
206285	2K3D	Nm	164,20	164,10	164,20	164,40	164,30	164,10	164,20	164,20	164,00	164,00
206285	2K3D	Grad	357,00	353,00	349,00	354,00	350,00	353,00	357,00	358,00	359,00	365,00

Char.No.	Char.Descr.	Unit	x_{21}	x_{22}	x_{23}	x_{24}	x_{25}	x_{26}	x_{27}	x_{28}	x_{29}	x_{30}
206285	2K3D	Nm	164,50	164,30	164,00	164,10	164,40	164,40	164,30	164,20	164,20	164,20
206285	2K3D	Grad	359,00	362,00	353,00	355,00	358,00	353,00	350,00	353,00	355,00	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}
206285	2K3D	Nm	164,10	164,10	164,10	164,10	164,30	164,20	164,20	164,20	164,10	164,20
206285	2K3D	Grad	348,00	352,00	352,00	351,00	356,00	351,00	360,00	356,00	363,00	350,00

Char.No.	Char.Descr.	Unit	x_{41}	x_{42}	x_{43}	x_{44}	x_{45}	x_{46}	x_{47}	x_{48}	x_{49}	x_{50}
206285	2K3D	Nm	164,10	164,30	164,20	164,10	164,40	164,30	164,00	164,10	164,10	164,60
206285	2K3D	Grad	353,00	347,00	357,00	351,00	358,00	351,00	354,00	361,00	368,00	351,00

Char.No.	Char.Descr.	Unit	x_{51}	x_{52}	x_{53}	x_{54}	x_{55}	x_{56}	x_{57}	x_{58}	x_{59}	x_{60}
206285	2K3D	Nm	164,30	164,10	164,00	164,10	164,10	164,10	164,10	164,30	164,50	164,30
206285	2K3D	Grad	362,00	353,00	344,00	353,00	350,00	352,00	355,00	353,00	353,00	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}
206285	2K3D	Nm	164,10	164,20	164,40	164,30	164,20	164,30	164,20	164,10	164,10	164,00
206285	2K3D	Grad	346,00	355,00	356,00	353,00	360,00	350,00	357,00	359,00	355,00	352,00

Char.No.	Char.Descr.	Unit	x_{71}	x_{72}	x_{73}	x_{74}	x_{75}	x_{76}	x_{77}	x_{78}	x_{79}	x_{80}
206285	2K3D	Nm	164,20	164,10	164,50	164,10	164,10	164,20	164,40	164,10	164,50	164,50
206285	2K3D	Grad	361,00	350,00	357,00	357,00	365,00	348,00	355,00	371,00	359,00	351,00

Machine Capability Study
Tool System

Plant	ATG Westhausen		Operator Name	Sünder	Date 29.04.2022

Serial No.	756057_g	Characteristic			
Part type	2BD-2B200A-2K3D-2ZB	Char.Descr.	2K3D	Nom.val.	164,00
Ord. No.	2BD200T1S-A	Serial No.	206285	LSL	152,52
				USL	175,48
Remark	TQ 80% soft +/-7% * TQ-Cal.: 200 Nm; Cur-Cal.: 5.751 Nm/A; Speed: 502/50 rpm;				

Char.No.	Char.Descr.	Unit	x_{81}	x_{82}	x_{83}	x_{84}	x_{85}	x_{86}	x_{87}	x_{88}	x_{89}	x_{90}
206285	2K3D	Nm	164,20	164,20	164,10	164,30	164,10	164,00	164,20	164,20	164,20	164,60
206285	2K3D	Grad	354,00	366,00	357,00	367,00	353,00	358,00	363,00	359,00	367,00	358,00

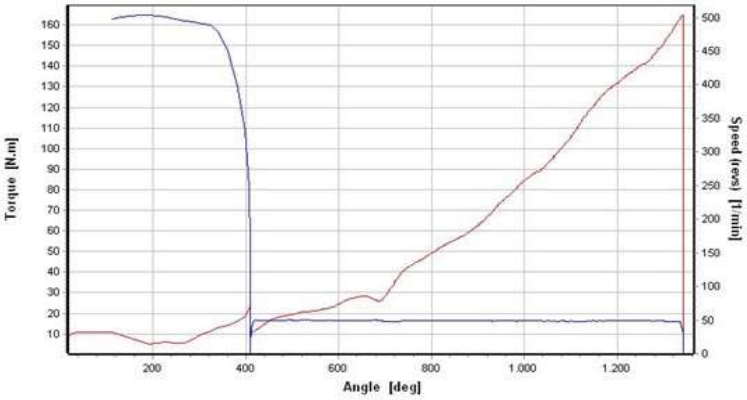
Char.No.	Char.Descr.	Unit	x_{91}	x_{92}	x_{93}	x_{94}	x_{95}	x_{96}	x_{97}	x_{98}	x_{99}	x_{100}
206285	2K3D	Nm	164,40	164,20	164,20	164,10	164,30	164,80	164,60	164,20	164,20	164,20
206285	2K3D	Grad	358,00	353,00	359,00	349,00	355,00	358,00	357,00	370,00	361,00	356,00

Torque graphs

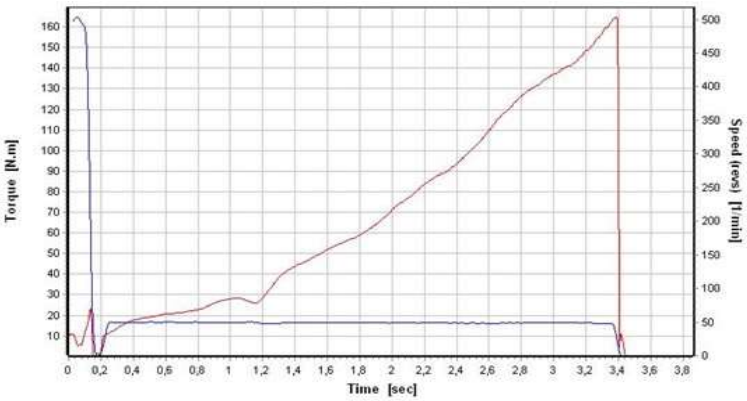
Machine Capability Study 80 %

Model: **2BD-2B200A-2K3D-2ZB**
Serial no: **756057**

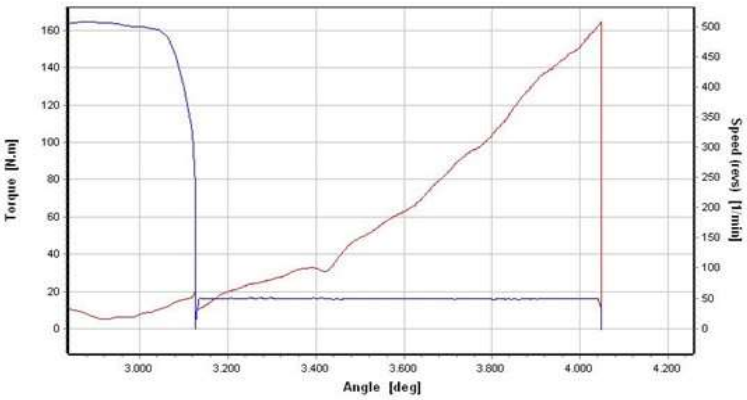
Angle degree: **360°**
Test torque: **164,0 Nm**



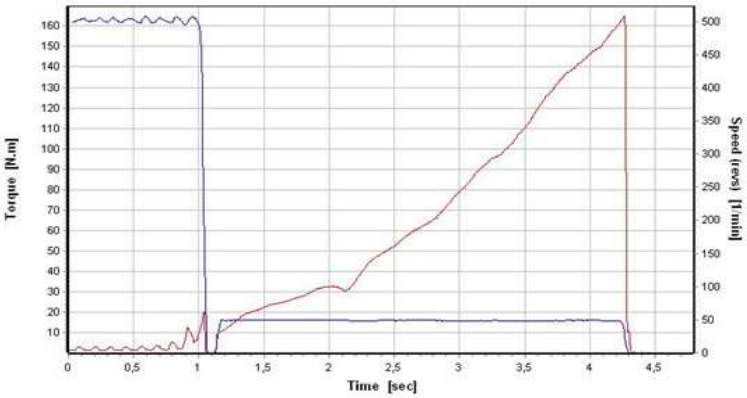
Value no. 1
Graph
Torque / Angle / Speed



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: **756057**

Test torque: Tq max. 200,00 Nm

Hard joint (H)	1212,08	Nm / Revolution	Angle degree	30°
Soft joint (L)	100,48	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	202,01	200,97 Nm
	Standard deviation	0,26	0,17 Nm
	Torque scatter (99,73%)	1,59	1,03 Nm
	C_m	17,62	27,31
	C_{mk}	15,09	25,42

b)	Min. C_m hard/soft (lowest value)	17,62
	Min. C_{mk} hard/soft (lowest value)	15,09

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

Note:

Machine Capability Study
Control System

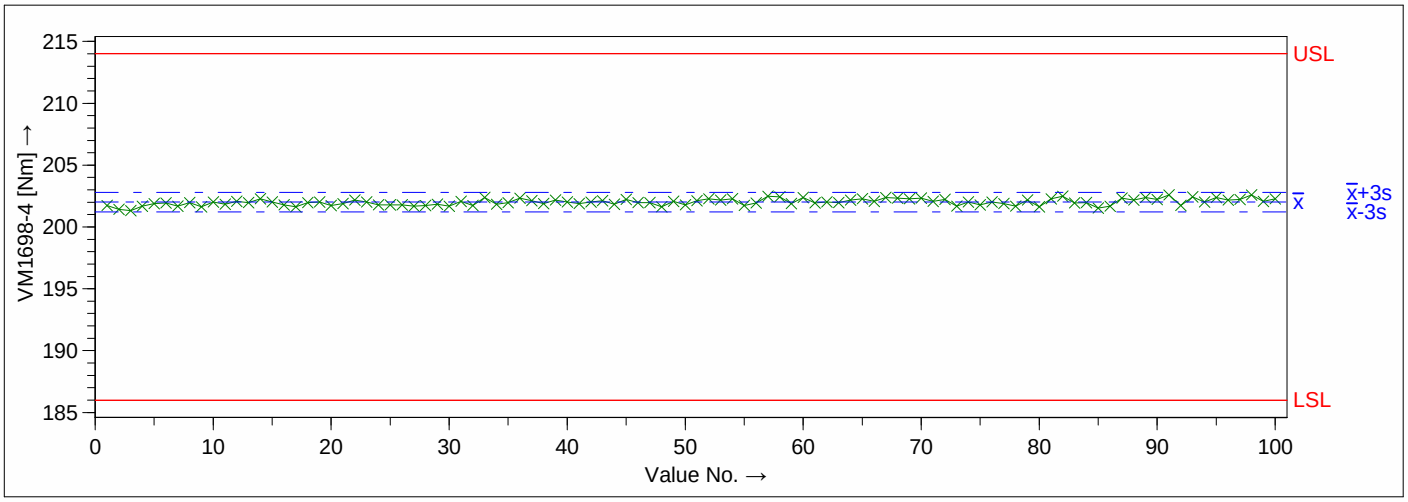
Cleco Production Tools

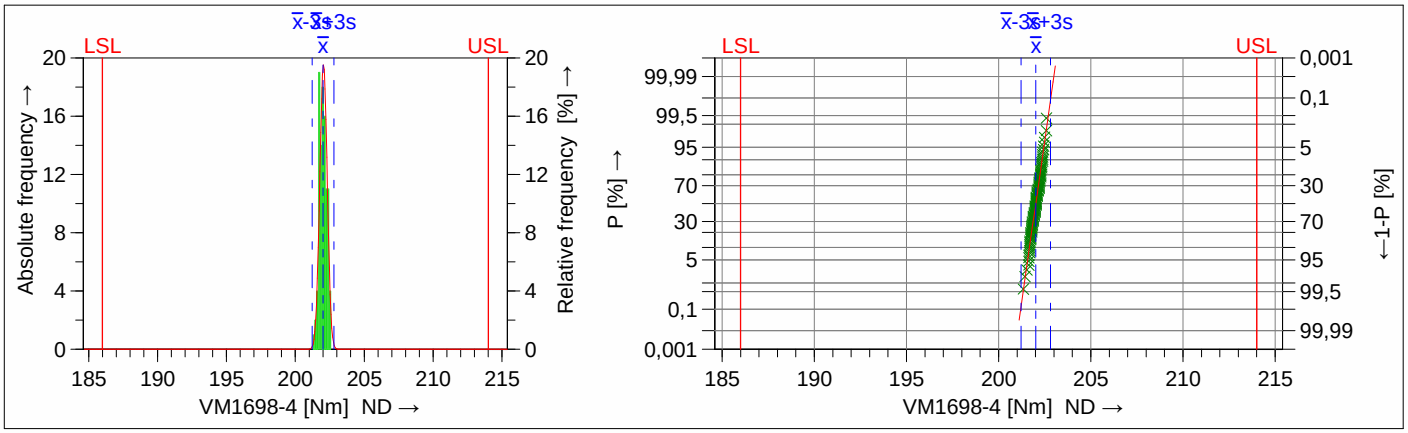
Plant	ATG Westhausen	Operator Name	Sünder
Date	28.04.2022		

Ord. No.	2BD200T1S-A	Part type	2BD-2B200A-2K3D-2ZB	Contr.item	yes
Serial No.	756057_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 28.04.2022 14:11:28 to 28.04.2022 14:25:32

Rem. TQ 100% hard +/-7% * TQ-Cal.: 200 Nm; Cur-Cal.: 5.537 Nm/A; Speed: 502/50 rpm;





Drawing Values		Collected Values		Statistics	
T_m	200.00			$\bar{x}$	202.0130
LSL	186.00	x_{min}	201.33	$\bar{x}$-3s	201.2186
USL	214.00	x_{max}	202.58	$\bar{x}$+3s	202.8074
T	28.00	R	1.25	6s	1.5887
		$n_{<T>}$	100	$p_{<T>}$	100.00000 %
		$n_{>USL}$	0	$p_{>USL}$	0.00000%
		$n_{<LSL}$	0	$p_{<LSL}$	0.00000%
		n_{eff}	100		
		n_{tot}	100		

Model distribution			Normal Distribution
Calculation method			M1.1.4 $\hat{\sigma} = S_{tot}$
Potential Capability index	=	C_m	17.62
Critical capability index	=	C_{mk}	15.09

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

APEX VDI/VDE 2647 V0.1

Machine Capability Study
Control System

Plant	ATG Westhausen		Operator Name	Sünder	Date 28.04.2022

Serial No.	756057_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.: 5.537 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	201,73	201,43	201,33	201,68	201,88	201,93	201,68	201,98	201,63	202,03
1024210	VM1698-4	Grad	29,00	30,00	29,75	29,75	29,75	29,75	29,75	30,00	29,25	29,50

Char.No.	Char.Descr.	Unit	x_{11}	x_{12}	x_{13}	x_{14}	x_{15}	x_{16}	x_{17}	x_{18}	x_{19}	x_{20}
1024210	VM1698-4	Nm	201,83	202,08	201,98	202,28	202,03	201,78	201,63	201,98	202,03	201,73
1024210	VM1698-4	Grad	29,25	29,75	29,50	29,50	29,75	29,25	29,25	29,25	29,75	29,75

Char.No.	Char.Descr.	Unit	x_{21}	x_{22}	x_{23}	x_{24}	x_{25}	x_{26}	x_{27}	x_{28}	x_{29}	x_{30}
1024210	VM1698-4	Nm	201,88	202,18	202,03	201,78	201,78	201,78	201,68	201,73	201,83	201,68
1024210	VM1698-4	Grad	30,00	29,50	29,75	29,75	29,75	29,50	29,25	29,25	29,25	29,75

Char.No.	Char.Descr.	Unit	x_{31}	x_{32}	x_{33}	x_{34}	x_{35}	x_{36}	x_{37}	x_{38}	x_{39}	x_{40}
1024210	VM1698-4	Nm	202,08	201,73	202,38	201,83	201,98	202,33	202,13	201,88	202,18	202,03
1024210	VM1698-4	Grad	29,75	29,50	30,00	29,75	29,50	29,25	30,00	30,00	30,00	30,00

Char.No.	Char.Descr.	Unit	x_{41}	x_{42}	x_{43}	x_{44}	x_{45}	x_{46}	x_{47}	x_{48}	x_{49}	x_{50}
1024210	VM1698-4	Nm	201,88	202,03	202,13	201,83	202,23	201,98	201,98	201,63	202,08	201,78
1024210	VM1698-4	Grad	29,75	29,50	30,25	29,75	29,75	29,75	29,25	29,75	30,25	30,00

Char.No.	Char.Descr.	Unit	x_{51}	x_{52}	x_{53}	x_{54}	x_{55}	x_{56}	x_{57}	x_{58}	x_{59}	x_{60}
1024210	VM1698-4	Nm	202,13	202,28	202,18	202,28	201,73	201,93	202,48	202,43	201,88	202,38
1024210	VM1698-4	Grad	30,00	29,25	30,00	29,75	29,50	30,00	29,75	29,00	29,75	29,50

Char.No.	Char.Descr.	Unit	x_{61}	x_{62}	x_{63}	x_{64}	x_{65}	x_{66}	x_{67}	x_{68}	x_{69}	x_{70}
1024210	VM1698-4	Nm	201,93	202,03	201,98	202,18	202,28	202,08	202,38	202,33	202,28	202,33
1024210	VM1698-4	Grad	30,00	30,00	29,25	29,50	29,75	29,50	29,50	29,75	29,00	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	202,08	202,23	201,68	202,03	201,78	202,03	201,88	201,68	202,18	201,63
1024210	VM1698-4	Grad	29,00	29,00	29,25	29,50	29,75	30,00	29,00	28,75	30,00	30,00

Machine Capability Study
Control System

Plant	ATG Westhausen		Operator Name	Sünder	Date 28.04.2022

Serial No.	756057_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.: 5.537 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	202,28	202,48	201,93	201,98	201,53	201,68	202,33	202,18	202,38	202,23
1024210	VM1698-4	Grad	30,00	29,50	29,75	29,50	30,25	29,50	30,00	29,50	30,00	29,50

Char.No.	Char.Descr.	Unit	x_{91}	x_{92}	x_{93}	x_{94}	x_{95}	x_{96}	x_{97}	x_{98}	x_{99}	x_{100}
1024210	VM1698-4	Nm	202,58	201,73	202,43	202,03	202,38	202,18	202,23	202,58	202,08	202,28
1024210	VM1698-4	Grad	30,00	30,00	30,50	30,00	30,50	29,75	30,25	29,50	30,00	29,75

Machine Capability Study
Tool System

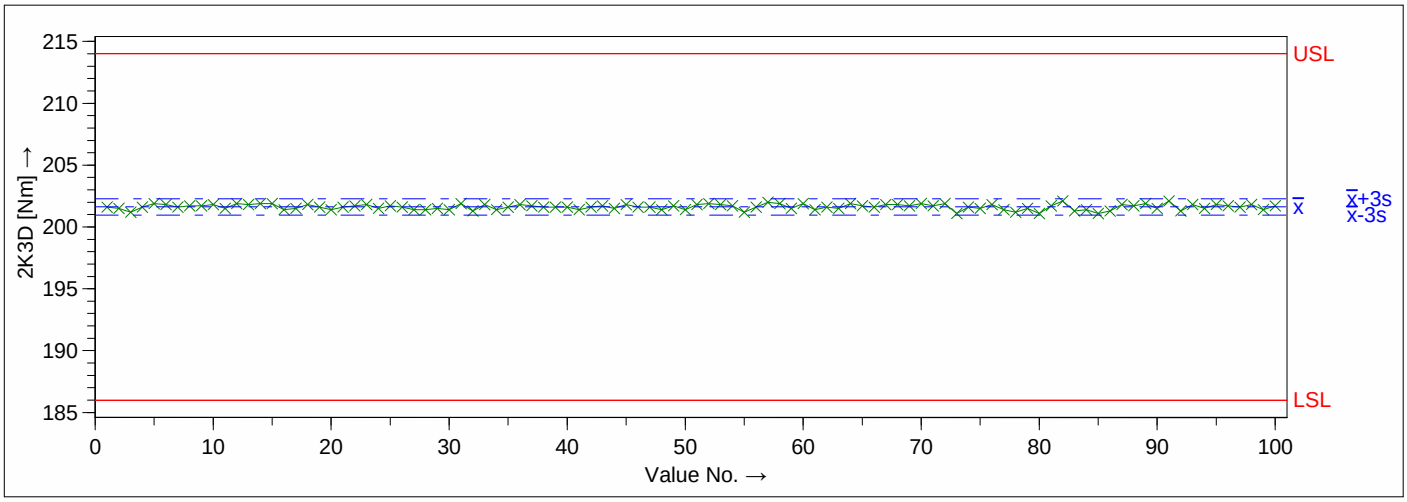
Page 1 / 1

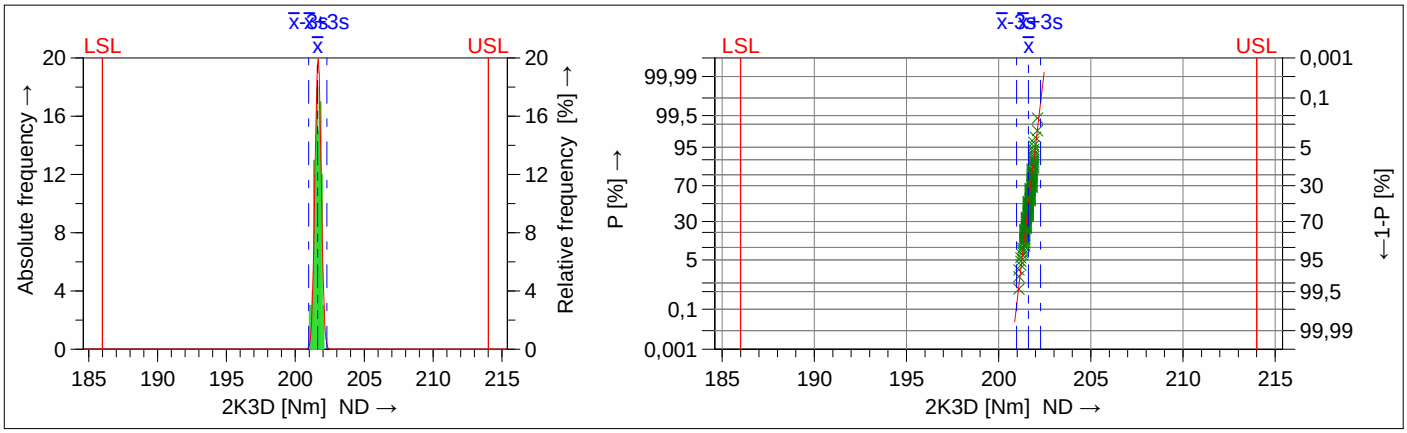
Plant	ATG Westhausen	Operator Name	Sünder
Date	28.04.2022		

Ord. No.	2BD200T1S-A	Part type	2BD-2B200A-2K3D-2ZB	Contr.item	yes
Serial No.	756057_b	Char.Descr.	2K3D	Nom.val.	200,00 14,00
		Serial No.	206285	Unit	Nm -14,00
				USL	214,00
				LSL	186,00
Char.Type	variable			Tolerance value	7 %
				Decimal Pl.	2
Cust.Name	Cleco	Reference System	VM1698-4	Test Electronic	MPRO400GCD-P
Contr.No.	Homologation	Reference Transducer	250 / 5537037	nges.	100

Evaluation from 28.04.2022 14:11:29 to 28.04.2022 14:25:33

Rem. TQ 100% hard +/-7% * TQ-Cal.: 200 Nm; Cur-Cal.: 5.537 Nm/A; Speed: 502/50 rpm;





Drawing Values		Collected Values		Statistics	
T_m	200.00			$\bar{x}$	201.6220
LSL	186.00	x_{min}	201.10	$\bar{x}$-3s	200.9648
USL	214.00	x_{max}	202.10	$\bar{x}$+3s	202.2792
T	28.00	R	1.00	6s	1.3145
		$n_{<T>}$	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	21.30
Critical capability index	=	C_{mk}	18.83

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

APEX VDI/VDE 2647 V0.1

Apex Tool Group GmbH \\htwe0006\Appdata\QW\QWE\Messwert\2022\756057_b1.DFD

Machine Capability Study
Tool System

Plant	ATG Westhausen		Operator Name	Sünder	Date 28.04.2022

Serial No.	756057_b	Characteristic			
Part type	2BD-2B200A-2K3D-2ZB	Char.Descr.	2K3D	Nom.val.	200,00
Ord. No.	2BD200T1S-A	Serial No.	206285	LSL	186,00
				USL	214,00
Remark	TQ 100% hard +/-7% * TQ-Cal.: 200 Nm; Cur-Cal.: 5.537 Nm/A; Speed: 502/50 rpm;				

Char.No.	Char.Descr.	Unit	x_1	x_2	x_3	x_4	x_5	x_6	x_7	x_8	x_9	x_{10}
206285	2K3D	Nm	201,60	201,50	201,20	201,60	201,90	201,80	201,60	201,70	201,70	201,80
206285	2K3D	Grad	30,00	30,00	30,00	30,00	30,00	31,00	30,00	31,00	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}
206285	2K3D	Nm	201,50	201,90	201,80	201,90	201,90	201,40	201,50	201,80	201,60	201,40
206285	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}
206285	2K3D	Nm	201,60	201,70	201,80	201,50	201,70	201,60	201,40	201,40	201,50	201,40
206285	2K3D	Grad	31,00	30,00	31,00	30,00	30,00	30,00	30,00	30,00	30,00	30,00

Char.No.	Char.Descr.	Unit	x_{31}	x_{32}	x_{33}	x_{34}	x_{35}	x_{36}	x_{37}	x_{38}	x_{39}	x_{40}
206285	2K3D	Nm	201,90	201,30	201,80	201,40	201,60	201,80	201,70	201,60	201,60	201,60
206285	2K3D	Grad	31,00	30,00	30,00	30,00	30,00	30,00	31,00	31,00	31,00	31,00

Char.No.	Char.Descr.	Unit	x_{41}	x_{42}	x_{43}	x_{44}	x_{45}	x_{46}	x_{47}	x_{48}	x_{49}	x_{50}
206285	2K3D	Nm	201,40	201,60	201,70	201,50	201,80	201,60	201,60	201,40	201,70	201,40
206285	2K3D	Grad	30,00	30,00	31,00	30,00	30,00	31,00	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}
206285	2K3D	Nm	201,80	201,90	201,80	201,70	201,20	201,60	202,00	201,90	201,50	201,90
206285	2K3D	Grad	30,00	31,00	30,00	30,00	30,00	30,00	30,00	30,00	30,00	30,00

Char.No.	Char.Descr.	Unit	x_{61}	x_{62}	x_{63}	x_{64}	x_{65}	x_{66}	x_{67}	x_{68}	x_{69}	x_{70}
206285	2K3D	Nm	201,40	201,60	201,50	201,90	201,70	201,60	201,80	201,80	201,70	201,90
206285	2K3D	Grad	30,00	30,00	31,00	30,00	30,00	30,00	30,00	30,00	30,00	30,00

Char.No.	Char.Descr.	Unit	x_{71}	x_{72}	x_{73}	x_{74}	x_{75}	x_{76}	x_{77}	x_{78}	x_{79}	x_{80}
206285	2K3D	Nm	201,70	201,90	201,10	201,60	201,50	201,80	201,40	201,20	201,50	201,10
206285	2K3D	Grad	30,00	30,00	30,00	30,00	30,00	31,00	30,00	30,00	31,00	30,00

Machine Capability Study
Tool System

Plant	ATG Westhausen		Operator Name	Sünder	Date 28.04.2022

Serial No.	756057_b	Characteristic			
Part type	2BD-2B200A-2K3D-2ZB	Char.Descr.	2K3D	Nom.val.	200,00
Ord. No.	2BD200T1S-A	Serial No.	206285	LSL	186,00
				USL	214,00
Remark	TQ 100% hard +/-7% * TQ-Cal.: 200 Nm; Cur-Cal.: 5.537 Nm/A; Speed: 502/50 rpm;				

Char.No.	Char.Descr.	Unit	x_{81}	x_{82}	x_{83}	x_{84}	x_{85}	x_{86}	x_{87}	x_{88}	x_{89}	x_{90}
206285	2K3D	Nm	201,70	202,10	201,30	201,40	201,10	201,30	201,80	201,70	201,90	201,50
206285	2K3D	Grad	30,00	30,00	30,00	31,00	31,00	31,00	31,00	31,00	31,00	31,00

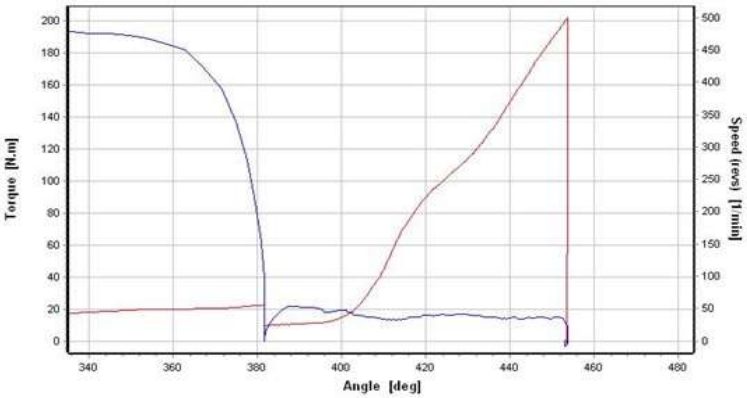
Char.No.	Char.Descr.	Unit	x_{91}	x_{92}	x_{93}	x_{94}	x_{95}	x_{96}	x_{97}	x_{98}	x_{99}	x_{100}
206285	2K3D	Nm	202,10	201,30	201,80	201,50	201,80	201,70	201,60	201,80	201,40	201,70
206285	2K3D	Grad	31,00	31,00	31,00	31,00	31,00	31,00	31,00	31,00	31,00	31,00

Torque graphs

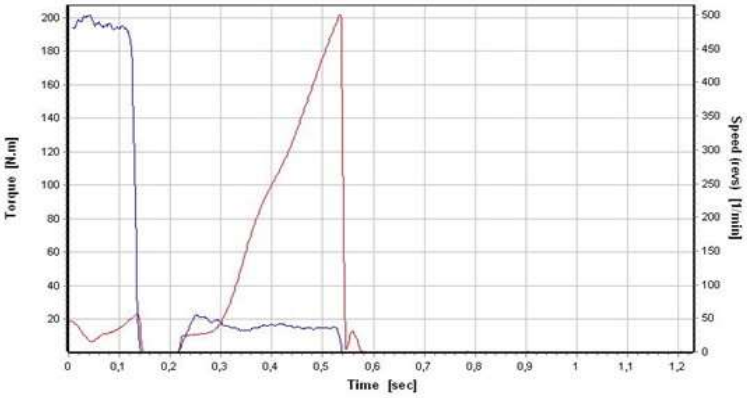
Machine Capability Study 100 %

Model: **2BD-2B200A-2K3D-2ZB**
Serial no: **756057**

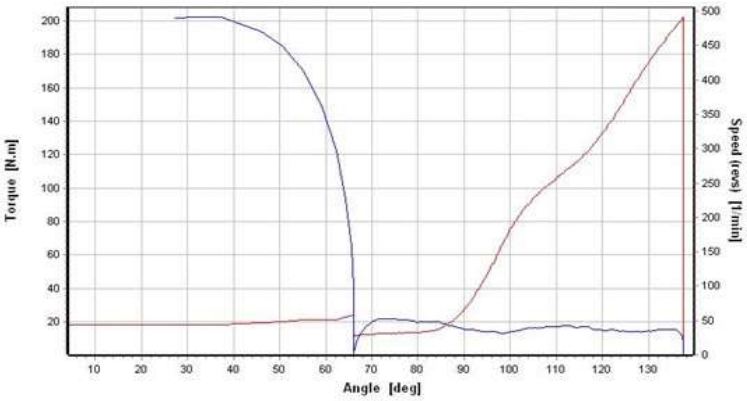
Angle degree: **30°**
Test torque: **200,0 Nm**



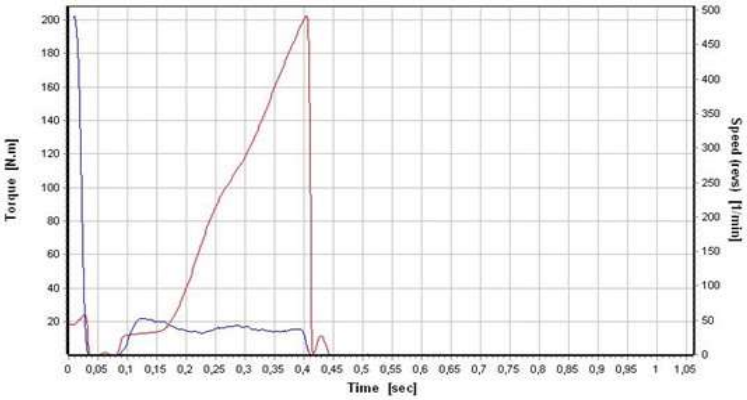
Value no. 1
Graph
Torque / Angle / Speed



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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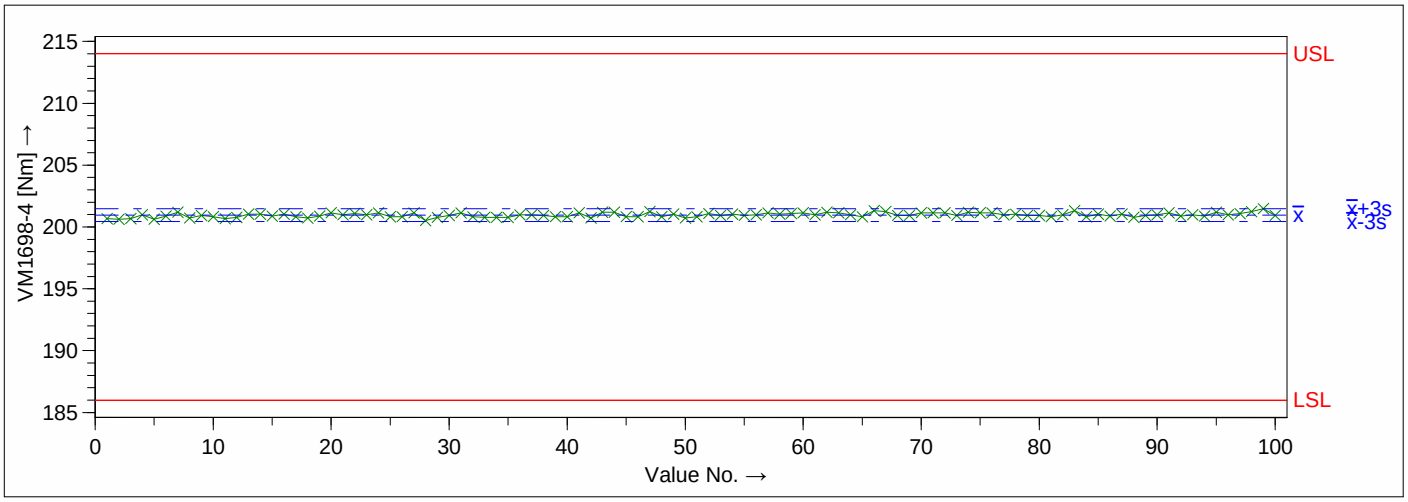
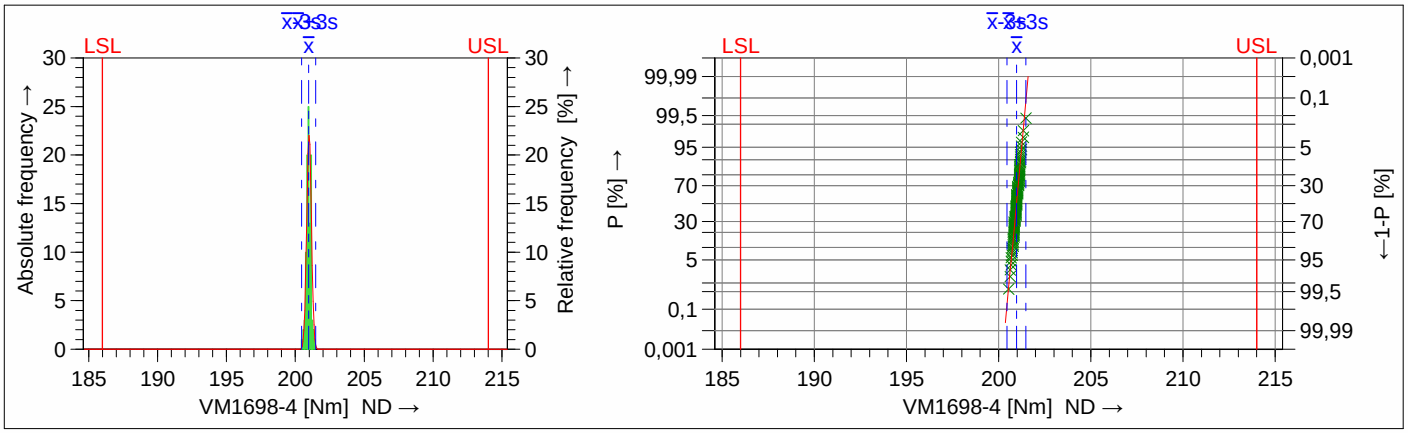
Plant	ATG Westhausen	Operator Name	Sünder
Date	28.04.2022		

Ord. No.	2BD200T1S-A	Part type	2BD-2B200A-2K3D-2ZB	Contr.item	yes
Serial No.	756057_a	Char.Descr.	VM1698-4	Nom.val.	200,00 14,00
		Serial No.	1024210	Unit	Nm -14,00
				USL	214,00
				LSL	186,00
Char.Type	variable			Tolerance value	7 %
				Decimal Pl.	2
Cust.Name	Cleco	Reference System	VM1698-4	Test Electronic	MPRO400GCD-P
Contr.No.	Homologation	Reference Transducer	250 / 5537037	nges.	100

Evaluation from 28.04.2022 15:45:26 to 28.04.2022 17:10:33

Rem. TQ 100% soft +/-7% * TQ-Cal.: 200 Nm; Cur-Cal.: 5.537 Nm/A; Speed: 502/50 rpm;





Drawing Values		Collected Values		Statistics	
T_m	200.00			$\bar{x}$	200.9655
LSL	186.00	x_{min}	200.53	$\bar{x}$-3s	200.4528
USL	214.00	x_{max}	201.48	$\bar{x}$+3s	201.4782
T	28.00	R	0.95	6s	1.0254
		$n_{<T>}$	100	$p_{<T>}$	100.00000 %
		$n_{>USL}$	0	$p_{>USL}$	0.00000%
		$n_{<LSL}$	0	$p_{<LSL}$	0.00000%
		n_{eff}	100		
		n_{tot}	100		

Model distribution			Normal Distribution
Calculation method			M1.1.4 $\hat{\sigma} = S_{tot}$
Potential Capability index	=	C_m	27.31
Critical capability index	=	C_{mk}	25.42

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 28.04.2022

Serial No.	756057_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.: 5.537 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	200,68	200,63	200,68	200,98	200,63	200,88	201,18	200,73	200,93	200,83
1024210	VM1698-4	Grad	360,50	353,75	349,25	348,00	343,75	343,50	348,50	339,50	336,50	334,75

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	200,68	200,78	201,03	201,03	200,88	201,03	200,83	200,73	200,88	201,13
1024210	VM1698-4	Grad	346,75	344,00	340,75	348,00	349,75	349,25	340,75	349,75	353,25	346,50

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	200,98	201,08	200,98	201,13	200,83	200,83	201,13	200,53	200,78	200,93
1024210	VM1698-4	Grad	345,00	356,25	354,25	354,00	350,50	352,00	345,75	351,00	351,75	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}
1024210	VM1698-4	Nm	201,13	200,83	200,78	200,78	200,78	200,98	200,98	200,93	200,83	200,83
1024210	VM1698-4	Grad	358,75	346,25	354,25	357,75	354,50	338,25	358,00	31,50	362,75	359,25

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	201,13	200,73	201,18	201,18	200,83	200,83	201,23	200,83	201,03	200,73
1024210	VM1698-4	Grad	359,00	361,50	360,00	357,25	363,25	358,75	359,25	356,25	359,75	361,25

Char.No.	Char.Descr.	Unit	x_{51}	x_{52}	x_{53}	x_{54}	x_{55}	x_{56}	x_{57}	x_{58}	x_{59}	x_{60}
1024210	VM1698-4	Nm	200,83	201,08	200,93	201,03	200,93	200,98	201,13	201,03	201,08	201,13
1024210	VM1698-4	Grad	363,00	360,50	349,75	360,25	362,75	362,75	359,75	361,00	357,00	360,25

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	200,98	201,18	201,13	200,98	200,83	201,33	201,23	200,93	200,93	201,13
1024210	VM1698-4	Grad	360,00	365,25	357,75	359,25	357,00	364,75	363,25	359,50	361,25	360,25

Char.No.	Char.Descr.	Unit	x_{71}	x_{72}	x_{73}	x_{74}	x_{75}	x_{76}	x_{77}	x_{78}	x_{79}	x_{80}
1024210	VM1698-4	Nm	201,13	201,13	200,93	201,18	201,13	201,13	200,98	201,03	200,93	200,93
1024210	VM1698-4	Grad	357,75	353,25	358,50	355,50	357,25	355,00	359,25	356,75	360,00	355,75

Machine Capability Study
Control System

Plant	ATG Westhausen		Operator Name	Sünder	Date 28.04.2022

Serial No.	756057_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.: 5.537 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	200,83	200,98	201,33	200,83	201,03	200,88	201,03	200,78	200,93	200,98
1024210	VM1698-4	Grad	358,75	355,75	360,75	362,25	361,00	354,75	352,50	358,25	358,25	355,25

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	200,88	200,98	200,88	201,18	200,98	201,08	201,23	201,48	200,93
1024210	VM1698-4	Grad	352,25	351,25	347,50	358,25	361,25	359,25	366,25	363,75	359,25	359,75

Machine Capability Study
Tool System

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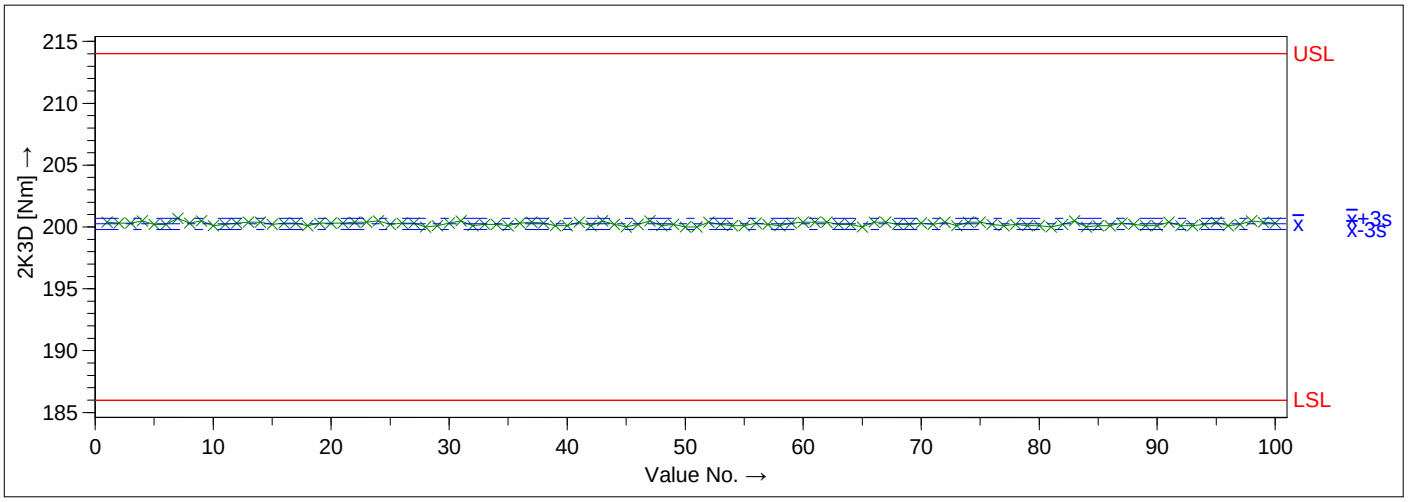
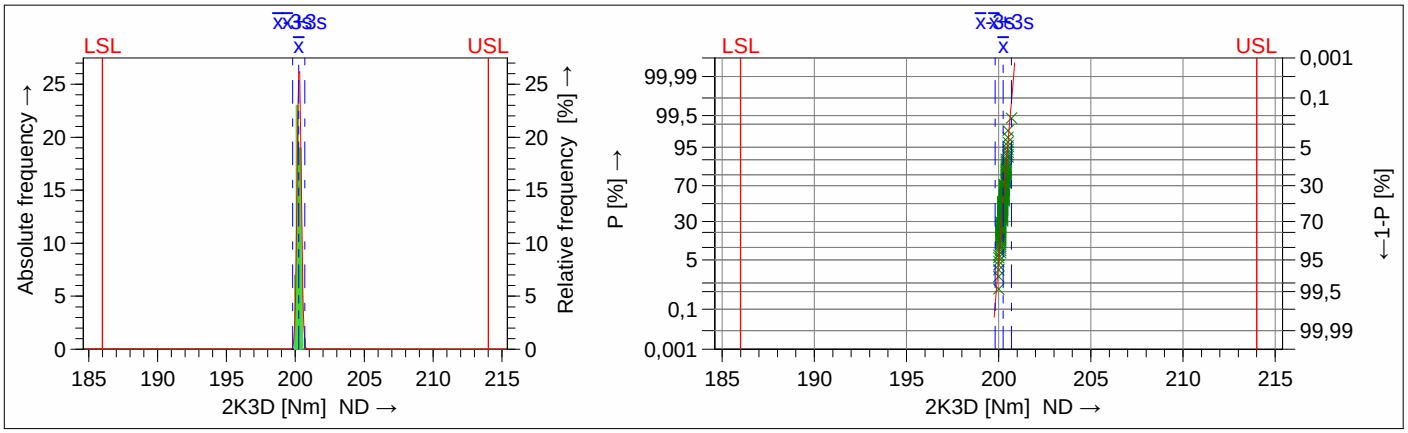
Plant	ATG Westhausen	Operator Name	Sünder
Date	28.04.2022		

Ord. No.	2BD200T1S-A	Part type	2BD-2B200A-2K3D-2ZB	Contr.item	yes
Serial No.	756057_a	Char.Descr.	2K3D	Nom.val.	200,00 14,00
		Serial No.	206285	Unit	Nm -14,00
				USL	214,00
				LSL	186,00
Char.Type	variable			Tolerance value	7 %
				Decimal Pl.	2
Cust.Name	Cleco	Reference System	VM1698-4	Test Electronic	MPRO400GCD-P
Contr.No.	Homologation	Reference Transducer	250 / 5537037	nges.	100

Evaluation from 28.04.2022 15:45:28 to 28.04.2022 17:10:34

Rem. TQ 100% soft +/-7% * TQ-Cal.: 200 Nm; Cur-Cal.: 5.537 Nm/A; Speed: 502/50 rpm;





Drawing Values		Collected Values		Statistics	
T_m	200.00			$\bar{x}$	200.2490
LSL	186.00	x_{min}	200.00	$\bar{x}$-3s	199.8028
USL	214.00	x_{max}	200.70	$\bar{x}$+3s	200.6952
T	28.00	R	0.70	6s	0.8924
		$n_{<T>}$	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	31.38
Critical capability index	=	C_{mk}	30.82

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

APEX VDI/VDE 2647 V0.1

Machine Capability Study
Tool System

Plant	ATG Westhausen		Operator Name	Sünder	Date 28.04.2022

Serial No.	756057_a	Characteristic			
Part type	2BD-2B200A-2K3D-2ZB	Char.Descr.	2K3D	Nom.val.	200,00
Ord. No.	2BD200T1S-A	Serial No.	206285	LSL	186,00
				USL	214,00
Remark	TQ 100% soft +/-7% * TQ-Cal.: 200 Nm; Cur-Cal.: 5.537 Nm/A; Speed: 502/50 rpm;				

Char.No.	Char.Descr.	Unit	x_1	x_2	x_3	x_4	x_5	x_6	x_7	x_8	x_9	x_{10}
206285	2K3D	Nm	200,40	200,30	200,30	200,50	200,20	200,20	200,70	200,30	200,50	200,10
206285	2K3D	Grad	361,00	354,00	347,00	349,00	344,00	343,00	349,00	339,00	337,00	334,00

Char.No.	Char.Descr.	Unit	x_{11}	x_{12}	x_{13}	x_{14}	x_{15}	x_{16}	x_{17}	x_{18}	x_{19}	x_{20}
206285	2K3D	Nm	200,20	200,30	200,40	200,40	200,20	200,30	200,30	200,10	200,30	200,30
206285	2K3D	Grad	347,00	342,00	340,00	348,00	350,00	350,00	339,00	349,00	354,00	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}
206285	2K3D	Nm	200,30	200,40	200,40	200,50	200,20	200,30	200,30	200,00	200,10	200,30
206285	2K3D	Grad	344,00	356,00	353,00	354,00	350,00	352,00	345,00	350,00	352,00	357,00

Char.No.	Char.Descr.	Unit	x_{31}	x_{32}	x_{33}	x_{34}	x_{35}	x_{36}	x_{37}	x_{38}	x_{39}	x_{40}
206285	2K3D	Nm	200,50	200,10	200,20	200,20	200,10	200,30	200,40	200,30	200,10	200,10
206285	2K3D	Grad	358,00	345,00	352,00	358,00	352,00	338,00	358,00	363,00	362,00	358,00

Char.No.	Char.Descr.	Unit	x_{41}	x_{42}	x_{43}	x_{44}	x_{45}	x_{46}	x_{47}	x_{48}	x_{49}	x_{50}
206285	2K3D	Nm	200,40	200,10	200,50	200,20	200,00	200,20	200,50	200,10	200,20	200,00
206285	2K3D	Grad	359,00	361,00	358,00	357,00	362,00	359,00	359,00	356,00	360,00	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}
206285	2K3D	Nm	200,00	200,40	200,20	200,10	200,10	200,30	200,20	200,10	200,30	200,40
206285	2K3D	Grad	362,00	360,00	349,00	360,00	363,00	362,00	359,00	361,00	355,00	360,00

Char.No.	Char.Descr.	Unit	x_{61}	x_{62}	x_{63}	x_{64}	x_{65}	x_{66}	x_{67}	x_{68}	x_{69}	x_{70}
206285	2K3D	Nm	200,40	200,40	200,20	200,20	200,00	200,40	200,40	200,20	200,20	200,30
206285	2K3D	Grad	360,00	364,00	357,00	359,00	357,00	365,00	362,00	359,00	361,00	359,00

Char.No.	Char.Descr.	Unit	x_{71}	x_{72}	x_{73}	x_{74}	x_{75}	x_{76}	x_{77}	x_{78}	x_{79}	x_{80}
206285	2K3D	Nm	200,20	200,40	200,10	200,40	200,40	200,20	200,10	200,20	200,10	200,10
206285	2K3D	Grad	358,00	352,00	358,00	354,00	355,00	355,00	358,00	356,00	359,00	355,00

Machine Capability Study
Tool System

Plant	ATG Westhausen		Operator Name	Sünder	Date 28.04.2022

Serial No.	756057_a	Characteristic			
Part type	2BD-2B200A-2K3D-2ZB	Char.Descr.	2K3D	Nom.val.	200,00
Ord. No.	2BD200T1S-A	Serial No.	206285	LSL	186,00
				USL	214,00
Remark	TQ 100% soft +/-7% * TQ-Cal.: 200 Nm; Cur-Cal.: 5.537 Nm/A; Speed: 502/50 rpm;				

Char.No.	Char.Descr.	Unit	x_{81}	x_{82}	x_{83}	x_{84}	x_{85}	x_{86}	x_{87}	x_{88}	x_{89}	x_{90}
206285	2K3D	Nm	200,00	200,20	200,50	200,00	200,10	200,10	200,30	200,20	200,10	200,10
206285	2K3D	Grad	359,00	355,00	361,00	362,00	360,00	354,00	352,00	359,00	356,00	355,00

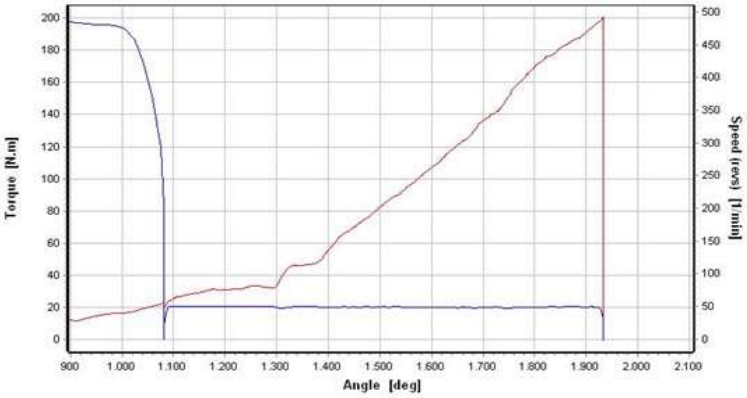
Char.No.	Char.Descr.	Unit	x_{91}	x_{92}	x_{93}	x_{94}	x_{95}	x_{96}	x_{97}	x_{98}	x_{99}	x_{100}
206285	2K3D	Nm	200,40	200,10	200,10	200,20	200,40	200,10	200,20	200,50	200,40	200,30
206285	2K3D	Grad	351,00	349,00	347,00	358,00	360,00	359,00	366,00	364,00	360,00	360,00

Torque graphs

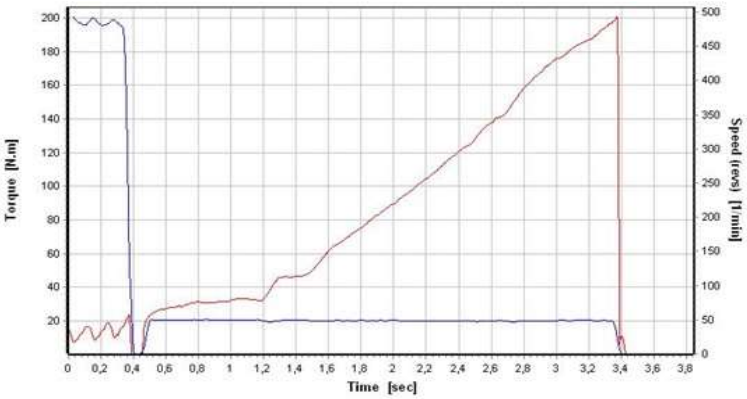
Machine Capability Study 100 %

Model: **2BD-2B200A-2K3D-2ZB**
Serial no: **756057**

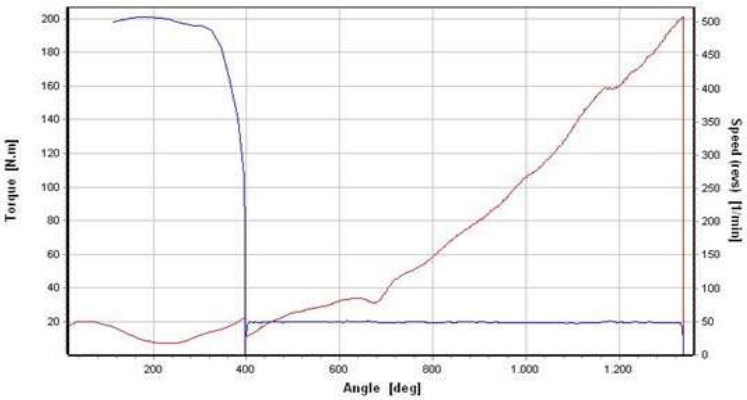
Angle degree: **360°**
Test torque: **200,0 Nm**



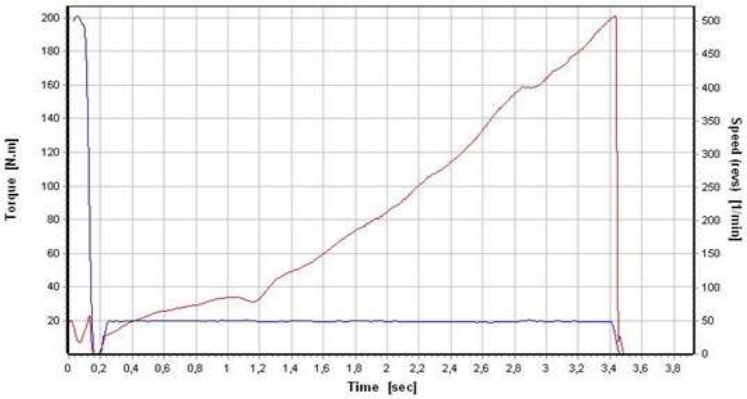
Value no. 1
Graph
Torque / Angle / Speed



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:** 756057

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: 0,82 % ± **0,41 %**

Angle degree: 40° Tolerance: 2,4° ± **1,2°**

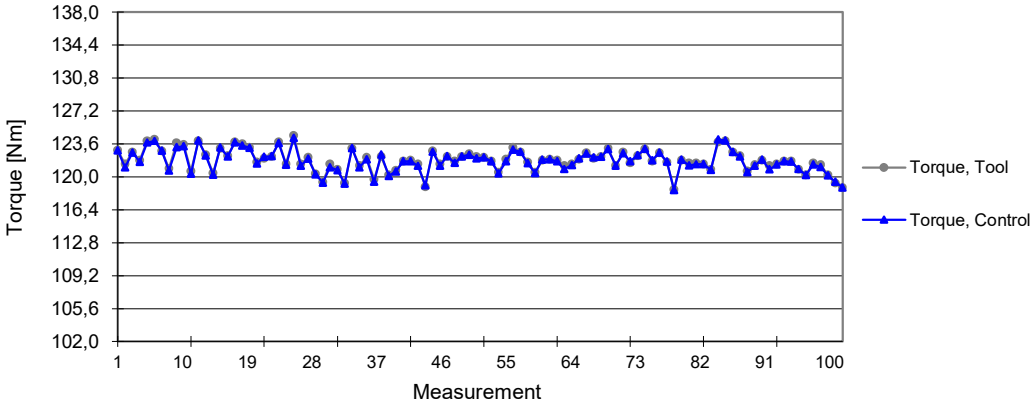
Formula derivation: $C_m = \frac{T}{6\,s}$ $T = C_m * 6\,s$

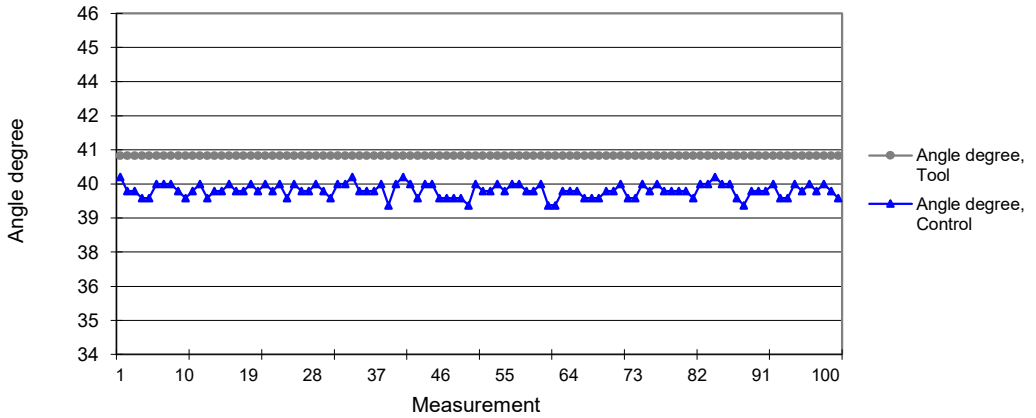
Tool without angle correction

Measurement	Tool data		Control data		Difference	
No.	Torque	Angle	Torque	Angle	Torque	Angle
1	122,90	41,00	122,90	40,25	0,00	0,75
2	121,40	41,00	121,00	39,75	0,40	1,25
3	122,70	41,00	122,65	39,75	0,05	1,25
4	121,80	41,00	121,62	39,50	0,18	1,50
5	123,90	41,00	123,74	39,50	0,16	1,50
6	124,10	41,00	123,91	40,00	0,19	1,00
7	122,80	41,00	122,83	40,00	0,03	1,00
8	120,90	41,00	120,68	40,00	0,22	1,00
9	123,70	41,00	123,22	39,75	0,48	1,25
10	123,50	41,00	123,32	39,50	0,18	1,50
11	120,60	41,00	120,31	39,75	0,29	1,25
12	123,90	41,00	123,98	40,00	0,08	1,00
13	122,40	41,00	122,31	39,50	0,09	1,50
14	120,40	41,00	120,24	39,75	0,16	1,25
15	123,10	41,00	123,20	39,75	0,10	1,25
16	122,30	41,00	122,23	40,00	0,07	1,00
17	123,80	41,00	123,76	39,75	0,04	1,25
18	123,60	41,00	123,42	39,75	0,18	1,25
19	123,20	41,00	123,17	40,00	0,03	1,00
20	121,60	41,00	121,45	39,75	0,15	1,25
21	122,00	41,00	122,18	40,00	0,18	1,00
22	122,20	41,00	122,26	39,75	0,06	1,25
23	123,80	41,00	123,69	40,00	0,11	1,00
24	121,40	41,00	121,30	39,50	0,10	1,50
25	124,50	41,00	124,23	40,00	0,27	1,00
26	121,40	41,00	121,20	39,75	0,20	1,25
27	122,10	41,00	121,96	39,75	0,14	1,25
28	120,30	41,00	120,26	40,00	0,04	1,00
29	119,40	41,00	119,35	39,75	0,05	1,25
30	121,40	41,00	121,03	39,50	0,37	1,50
31	120,80	41,00	120,73	40,00	0,07	1,00
32	119,30	41,00	119,25	40,00	0,05	1,00
33	123,10	41,00	123,12	40,25	0,02	0,75
34	121,20	41,00	121,05	39,75	0,15	1,25
35	122,10	41,00	121,91	39,75	0,19	1,25
36	119,70	41,00	119,45	39,75	0,25	1,25
37	122,20	41,00	122,43	40,00	0,23	1,00
38	120,20	41,00	120,07	39,25	0,13	1,75
39	120,70	41,00	120,58	40,00	0,12	1,00
40	121,70	41,00	121,69	40,25	0,01	0,75
41	121,80	41,00	121,72	40,00	0,08	1,00
42	121,40	41,00	121,17	39,50	0,23	1,50
43	118,90	41,00	119,06	40,00	0,16	1,00
44	122,80	41,00	122,73	40,00	0,07	1,00
45	121,40	41,00	121,20	39,50	0,20	1,50
46	122,20	41,00	122,26	39,50	0,06	1,50
47	121,70	41,00	121,49	39,50	0,21	1,50
48	122,20	41,00	122,23	39,50	0,03	1,50
49	122,50	41,00	122,41	39,25	0,09	1,75
50	122,20	41,00	122,01	40,00	0,19	1,00
51	122,10	41,00	122,11	39,75	0,01	1,25
52	121,70	41,00	121,72	39,75	0,02	1,25
53	120,50	41,00	120,36	40,00	0,14	1,00
54	121,90	41,00	121,67	39,75	0,23	1,25
55	123,20	41,00	122,97	40,00	0,23	1,00
56	122,70	41,00	122,73	40,00	0,03	1,00
57	121,60	41,00	121,47	39,75	0,13	1,25
58	120,50	41,00	120,41	39,75	0,09	1,25
59	121,80	41,00	121,89	40,00	0,09	1,00
60	121,90	41,00	121,91	39,25	0,01	1,75
61	121,80	41,00	121,69	39,25	0,11	1,75
62	121,20	41,00	120,83	39,75	0,37	1,25
63	121,40	41,00	121,27	39,75	0,13	1,25
64	121,90	41,00	121,99	39,75	0,09	1,25
65	122,60	41,00	122,53	39,50	0,07	1,50
66	122,00	41,00	122,11	39,50	0,11	1,50
67	122,20	41,00	122,18	39,50	0,02	1,50
68	123,10	41,00	123,02	39,75	0,08	1,25
69	121,20	41,00	121,22	39,75	0,02	1,25
70	122,70	41,00	122,58	40,00	0,12	1,00
71	121,50	41,00	121,72	39,50	0,22	1,50
72	122,30	41,00	122,36	39,50	0,06	1,50
73	123,00	41,00	123,05	40,00	0,05	1,00
74	121,70	41,00	121,79	39,75	0,09	1,25
75	122,60	41,00	122,63	40,00	0,03	1,00
76	121,60	41,00	121,64	39,75	0,04	1,25
77	118,60	41,00	118,54	39,75	0,06	1,25
78	121,80	41,00	121,84	39,75	0,04	1,25
79	121,50	41,00	121,25	39,75	0,25	1,25
80	121,50	41,00	121,35	39,50	0,15	1,50
81	121,40	41,00	121,40	40,00	0,00	1,00
82	120,80	41,00	120,76	40,00	0,04	1,00
83	123,80	41,00	124,06	40,25	0,26	0,75
84	123,90	41,00	123,96	40,00	0,06	1,00
85	122,70	41,00	122,70	40,00	0,00	1,00
86	122,30	41,00	122,23	39,50	0,07	1,50
87	120,60	41,00	120,48	39,25	0,12	1,75
88	121,30	41,00	121,20	39,75	0,10	1,25
89	121,80	41,00	121,89	39,75	0,09	1,25
90	121,20	41,00	120,80	39,75	0,40	1,25
91	121,40	41,00	121,32	40,00	0,08	1,00
92	121,70	41,00	121,72	39,50	0,02	1,50
93	121,70	41,00	121,64	39,50	0,06	1,50
94	120,80	41,00	120,83	40,00	0,03	1,00
95	120,20	41,00	120,19	39,75	0,01	1,25
96	121,50	41,00	121,32	40,00	0,18	1,00
97	121,30	41,00	121,08	39,75	0,22	1,25
98	120,20	41,00	120,14	40,00	0,06	1,00
99	119,30	41,00	119,43	39,75	0,13	1,25
100	118,80	41,00	118,83	39,50	0,03	1,50
				Standard deviation:	**0,098**	**0,237**

Graphical representation

Model:	**2BD-2B200A-2K3D-2ZB**	Serial no:	**756057**
Target torque:	**120,00 Nm**	60 % of max. torque	
Angle degree:	**40°**	Tool without angle correction	





Machine Capability Study
Control System

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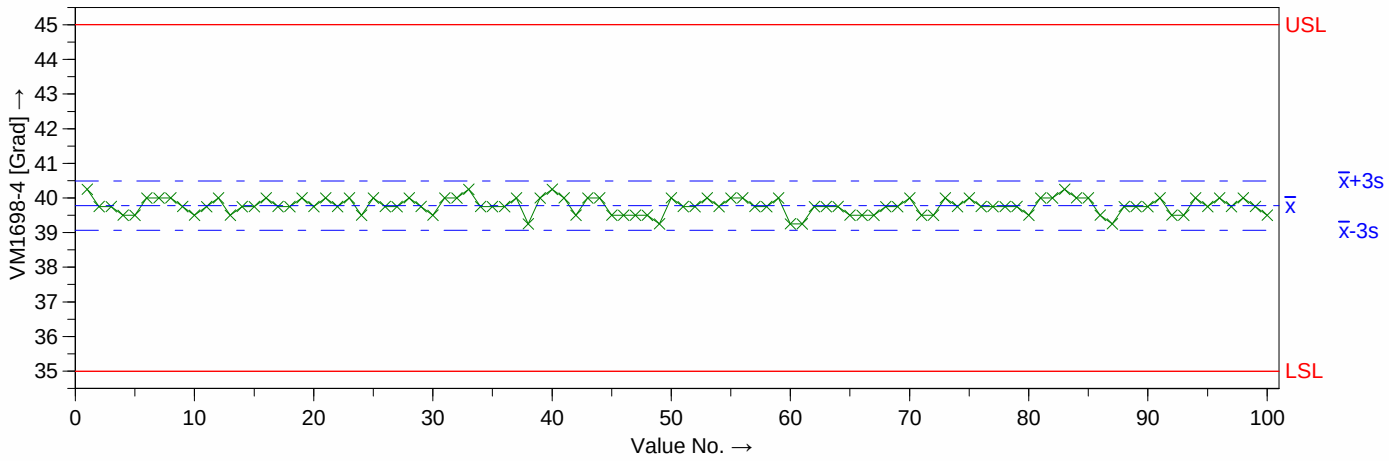
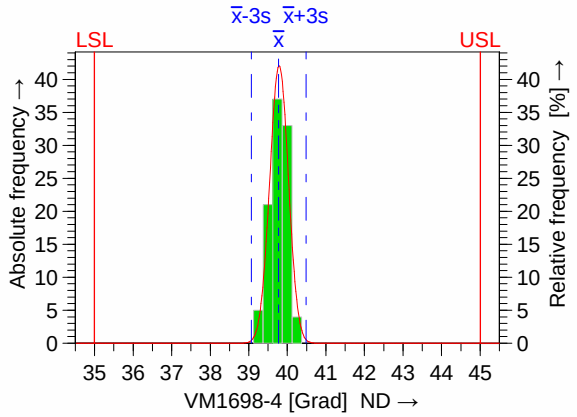
Plant	ATG Westhausen	Operator Name	Sünder
Date	29.04.2022		

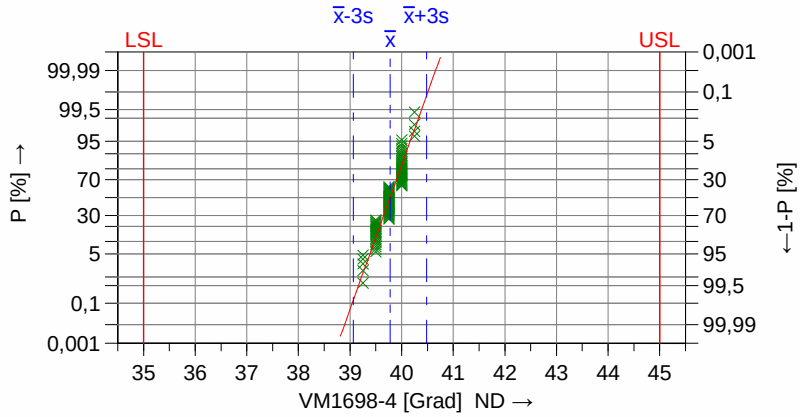
Ord. No.	2BD200T1S-A	Part type	2BD-2B200A-2K3D-2ZB	Contr.item	yes
Serial No.	756057_k	Char.Descr.	VM1698-4	Nom.val. 40,00 5,00	USL 45,00
		Serial No.	1024210	Unit Grad -5,00	LSL 35,00
Char.Type	variable			Tolerance value 12 %	Decimal Pl. 2
Cust.Name	Cleco	Reference System	VM1698-4	Test Electronic	MPRO400GCD-P
Contr.No.	Homologation	Reference Transducer	120 / 1019923	nges.	100

Evaluation from 29.04.2022 09:48:55 to 29.04.2022 10:03:11

Rem. TQ 60% Angle 40° +/-5° * TQ-Cal.: 200 Nm; Cur-Cal.: 5.641 Nm/A; Speed: 300/50 rpm;







Drawing Values		Collected Values		Statistics	
T_m	40.00			$\bar{x}$	39.7750
LSL	35.00	x_{min}	39.25	$\bar{x}$-3s	39.0639
USL	45.00	x_{max}	40.25	$\bar{x}$+3s	40.4861
T	10.00	R	1.00	6s	1.4222
		$n_{<T>}$	100	$p_{<T>}$	100.00000 %
		$n_{>USL}$	0	$p_{>USL}$	0.00000%
		$n_{<LSL}$	0	$p_{<LSL}$	0.00000%
		n_{eff}	100		
		n_{tot}	100		

Model distribution			Normal Distribution
Calculation method			M1.1.4 $\hat{\sigma} = s_{tot}$
Potential Capability index	=	C_m	7.03
Critical capability index	=	C_{mk}	6.71

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 29.04.2022

Serial No.	756057_k	Characteristic			
Part type	2BD-2B200A-2K3D-2ZB	Char.Descr.	VM1698-4	Nom.val.	121,62
Ord. No.	2BD200T1S-A	Serial No.	1024210	LSL	94,83
				USL	149,64
Remark	TQ 60% Angle 40°+/-5°* TQ-Cal.: 200 Nm; Cur -Cal.: 5.641 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	122,90	121,00	122,65	121,62	123,74	123,91	122,83	120,68	123,22	123,32
1024210	VM1698-4	Grad	40,25	39,75	39,75	39,50	39,50	40,00	40,00	40,00	39,75	39,50

Char.No.	Char.Descr.	Unit	x_{11}	x_{12}	x_{13}	x_{14}	x_{15}	x_{16}	x_{17}	x_{18}	x_{19}	x_{20}
1024210	VM1698-4	Nm	120,31	123,98	122,31	120,24	123,20	122,23	123,76	123,42	123,17	121,45
1024210	VM1698-4	Grad	39,75	40,00	39,50	39,75	39,75	40,00	39,75	39,75	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	122,18	122,26	123,69	121,30	124,23	121,20	121,96	120,26	119,35	121,03
1024210	VM1698-4	Grad	40,00	39,75	40,00	39,50	40,00	39,75	39,75	40,00	39,75	39,50

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	120,73	119,25	123,12	121,05	121,91	119,45	122,43	120,07	120,58	121,69
1024210	VM1698-4	Grad	40,00	40,00	40,25	39,75	39,75	39,75	40,00	39,25	40,00	40,25

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	121,72	121,17	119,06	122,73	121,20	122,26	121,49	122,23	122,41	122,01
1024210	VM1698-4	Grad	40,00	39,50	40,00	40,00	39,50	39,50	39,50	39,50	39,25	40,00

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	122,11	121,72	120,36	121,67	122,97	122,73	121,47	120,41	121,89	121,91
1024210	VM1698-4	Grad	39,75	39,75	40,00	39,75	40,00	40,00	39,75	39,75	40,00	39,25

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	121,69	120,83	121,27	121,99	122,53	122,11	122,18	123,02	121,22	122,58
1024210	VM1698-4	Grad	39,25	39,75	39,75	39,75	39,50	39,50	39,50	39,75	39,75	40,00

Char.No.	Char.Descr.	Unit	x_{71}	x_{72}	x_{73}	x_{74}	x_{75}	x_{76}	x_{77}	x_{78}	x_{79}	x_{80}
1024210	VM1698-4	Nm	121,72	122,36	123,05	121,79	122,63	121,64	118,54	121,84	121,25	121,35
1024210	VM1698-4	Grad	39,50	39,50	40,00	39,75	40,00	39,75	39,75	39,75	39,75	39,50

Machine Capability Study
Control System

Plant	ATG Westhausen		Operator Name	Sünder	Date 29.04.2022

Serial No.	756057_k	Characteristic			
Part type	2BD-2B200A-2K3D-2ZB	Char.Descr.	VM1698-4	Nom.val.	121,62
Ord. No.	2BD200T1S-A	Serial No.	1024210	LSL	94,83
				USL	149,64
Remark	TQ 60% Angle 40°+/-5°* TQ-Cal.: 200 Nm; Cur -Cal.: 5.641 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	121,40	120,76	124,06	123,96	122,70	122,23	120,48	121,20	121,89	120,80
1024210	VM1698-4	Grad	40,00	40,00	40,25	40,00	40,00	39,50	39,25	39,75	39,75	39,75

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	121,32	121,72	121,64	120,83	120,19	121,32	121,08	120,14	119,43	118,83
1024210	VM1698-4	Grad	40,00	39,50	39,50	40,00	39,75	40,00	39,75	40,00	39,75	39,50

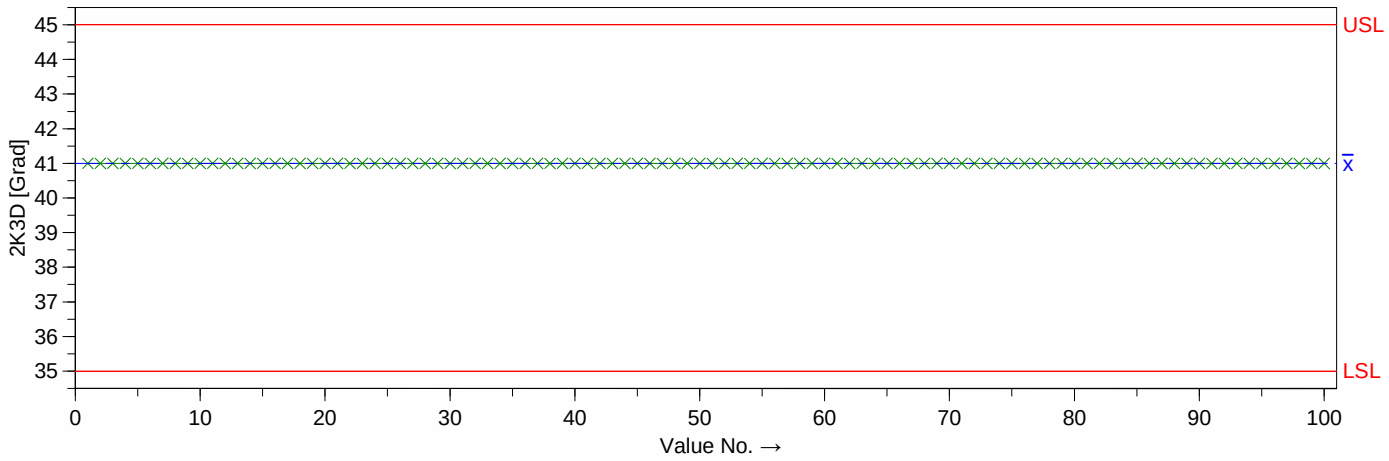
Machine Capability Study
Tool System

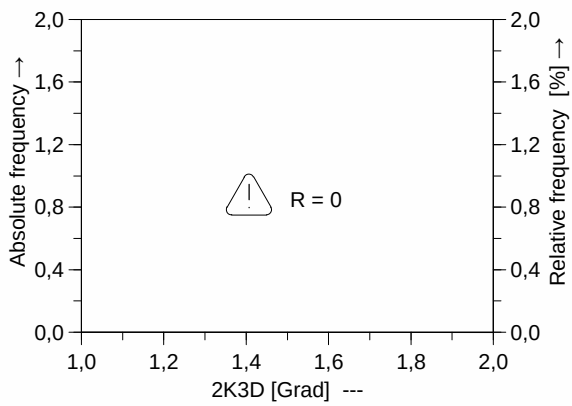
Plant	ATG Westhausen	Operator Name	Sünder
Date	29.04.2022		

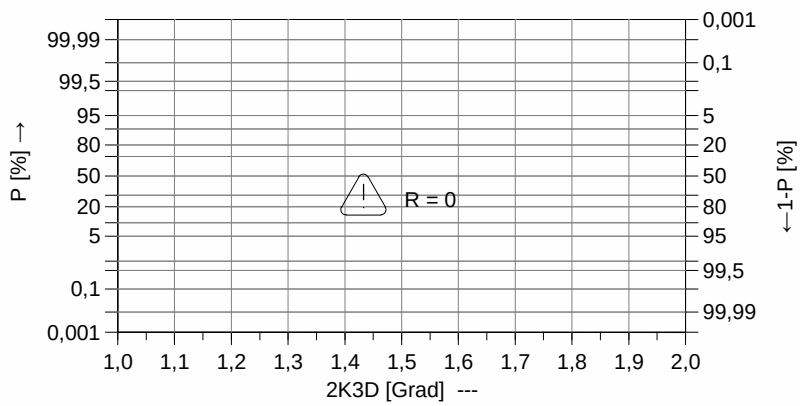
Ord. No.	2BD200T1S-A	Part type	2BD-2B200A-2K3D-2ZB	Contr.item	yes
Serial No.	756057_k	Char.Descr.	2K3D	Nom.val. 40,00 5,00	USL 45,00
		Serial No.	206285	Unit Grad -5,00	LSL 35,00
Char.Type	variable			Tolerance value 12 %	Decimal Pl. 2
Cust.Name	Cleco	Reference System	VM1698-4	Test Electronic	MPRO400GCD-P
Contr.No.	Homologation	Reference Transducer	120 / 1019923	nges.	100

Evaluation from 29.04.2022 09:48:56 to 29.04.2022 10:03:12

Rem. TQ 60% Angle 40° +/-5° * TQ-Cal.: 200 Nm; Cur-Cal.: 5.641 Nm/A; Speed: 300/50 rpm;







Drawing Values		Collected Values		Statistics	
T_m	40.00			$\bar{x}$	41.0000
LSL	35.00	x_{min}	41.00		
USL	45.00	x_{max}	41.00		
T	10.00	R	0.00		
		$n_{<T>}$	100		
		$n_{>USL}$	0		
		$n_{<LSL}$	0		
		n_{eff}	100		
		n_{tot}	100		

--- R = 0 ---

APEX VDI/VDE 2647 V0.1

Machine Capability Study
Tool System

Plant	ATG Westhausen		Operator Name	Sünder	Date 29.04.2022

Serial No.	756057_k	Characteristic			
Part type	2BD-2B200A-2K3D-2ZB	Char.Descr.	2K3D	Nom.val.	62,35
Ord. No.	2BD200T1S-A	Serial No.	206285	LSL	0,00
				USL	149,64
Remark	TQ 60% Angle 40°+/-5°* TQ-Cal.: 200 Nm; Cur -Cal.: 5.641 Nm/A; Speed: 300/50 rpm;				

Char.No.	Char.Descr.	Unit	x_1	x_2	x_3	x_4	x_5	x_6	x_7	x_8	x_9	x_{10}
206285	2K3D	Nm	122,90	121,40	122,70	121,80	123,90	124,10	122,80	120,90	123,70	123,50
206285	2K3D	Grad	41,00	41,00	41,00	41,00	41,00	41,00	41,00	41,00	41,00	41,00

Char.No.	Char.Descr.	Unit	x_{11}	x_{12}	x_{13}	x_{14}	x_{15}	x_{16}	x_{17}	x_{18}	x_{19}	x_{20}
206285	2K3D	Nm	120,60	123,90	122,40	120,40	123,10	122,30	123,80	123,60	123,20	121,60
206285	2K3D	Grad	41,00	41,00	41,00	41,00	41,00	41,00	41,00	41,00	41,00	41,00

Char.No.	Char.Descr.	Unit	x_{21}	x_{22}	x_{23}	x_{24}	x_{25}	x_{26}	x_{27}	x_{28}	x_{29}	x_{30}
206285	2K3D	Nm	122,00	122,20	123,80	121,40	124,50	121,40	122,10	120,30	119,40	121,40
206285	2K3D	Grad	41,00	41,00	41,00	41,00	41,00	41,00	41,00	41,00	41,00	41,00

Char.No.	Char.Descr.	Unit	x_{31}	x_{32}	x_{33}	x_{34}	x_{35}	x_{36}	x_{37}	x_{38}	x_{39}	x_{40}
206285	2K3D	Nm	120,80	119,30	123,10	121,20	122,10	119,70	122,20	120,20	120,70	121,70
206285	2K3D	Grad	41,00	41,00	41,00	41,00	41,00	41,00	41,00	41,00	41,00	41,00

Char.No.	Char.Descr.	Unit	x_{41}	x_{42}	x_{43}	x_{44}	x_{45}	x_{46}	x_{47}	x_{48}	x_{49}	x_{50}
206285	2K3D	Nm	121,80	121,40	118,90	122,80	121,40	122,20	121,70	122,20	122,50	122,20
206285	2K3D	Grad	41,00	41,00	41,00	41,00	41,00	41,00	41,00	41,00	41,00	41,00

Char.No.	Char.Descr.	Unit	x_{51}	x_{52}	x_{53}	x_{54}	x_{55}	x_{56}	x_{57}	x_{58}	x_{59}	x_{60}
206285	2K3D	Nm	122,10	121,70	120,50	121,90	123,20	122,70	121,60	120,50	121,80	121,90
206285	2K3D	Grad	41,00	41,00	41,00	41,00	41,00	41,00	41,00	41,00	41,00	41,00

Char.No.	Char.Descr.	Unit	x_{61}	x_{62}	x_{63}	x_{64}	x_{65}	x_{66}	x_{67}	x_{68}	x_{69}	x_{70}
206285	2K3D	Nm	121,80	121,20	121,40	121,90	122,60	122,00	122,20	123,10	121,20	122,70
206285	2K3D	Grad	41,00	41,00	41,00	41,00	41,00	41,00	41,00	41,00	41,00	41,00

Char.No.	Char.Descr.	Unit	x_{71}	x_{72}	x_{73}	x_{74}	x_{75}	x_{76}	x_{77}	x_{78}	x_{79}	x_{80}
206285	2K3D	Nm	121,50	122,30	123,00	121,70	122,60	121,60	118,60	121,80	121,50	121,50
206285	2K3D	Grad	41,00	41,00	41,00	41,00	41,00	41,00	41,00	41,00	41,00	41,00

Machine Capability Study
Tool System

Plant	ATG Westhausen		Operator Name	Sünder	Date 29.04.2022

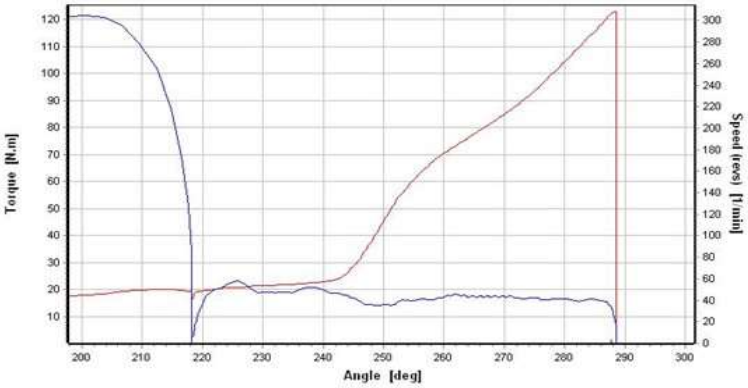
Serial No.	756057_k	Characteristic			
Part type	2BD-2B200A-2K3D-2ZB	Char.Descr.	2K3D	Nom.val.	62,35
Ord. No.	2BD200T1S-A	Serial No.	206285	LSL	0,00
				USL	149,64
Remark	TQ 60% Angle 40°+/-5°* TQ-Cal.: 200 Nm; Cur -Cal.: 5.641 Nm/A; Speed: 300/50 rpm;				

Char.No.	Char.Descr.	Unit	x_{81}	x_{82}	x_{83}	x_{84}	x_{85}	x_{86}	x_{87}	x_{88}	x_{89}	x_{90}
206285	2K3D	Nm	121,40	120,80	123,80	123,90	122,70	122,30	120,60	121,30	121,80	121,20
206285	2K3D	Grad	41,00	41,00	41,00	41,00	41,00	41,00	41,00	41,00	41,00	41,00

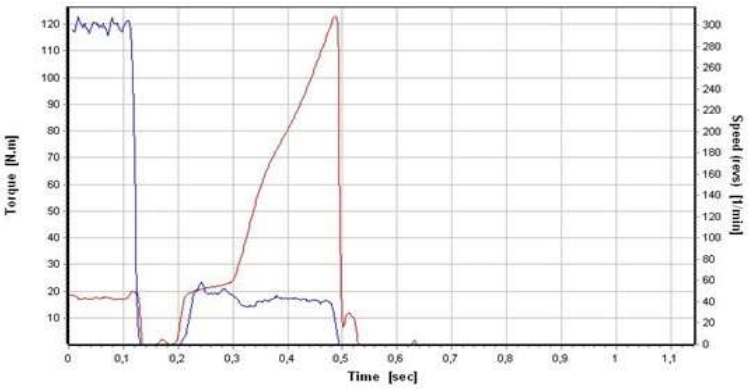
Char.No.	Char.Descr.	Unit	x_{91}	x_{92}	x_{93}	x_{94}	x_{95}	x_{96}	x_{97}	x_{98}	x_{99}	x_{100}
206285	2K3D	Nm	121,40	121,70	121,70	120,80	120,20	121,50	121,30	120,20	119,30	118,80
206285	2K3D	Grad	41,00	41,00	41,00	41,00	41,00	41,00	41,00	41,00	41,00	41,00

Torque graphs

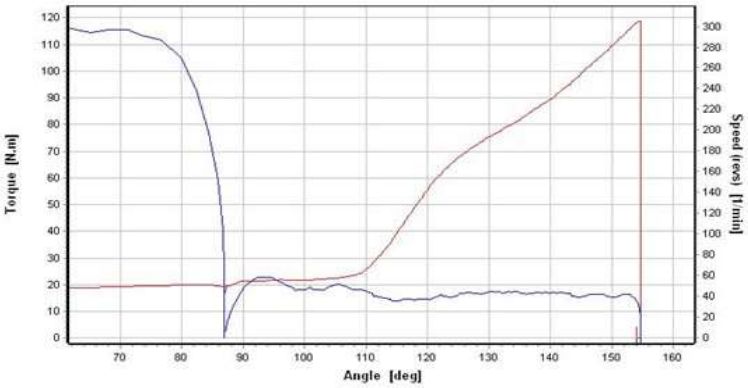
Model:	**2BD-2B200A-2K3D-2ZB**	Serial no:	**756057**
Target torque:	**120,00 Nm**	60 % of max. torque	
Angle degree:	**40°**	Tool without angle correction	



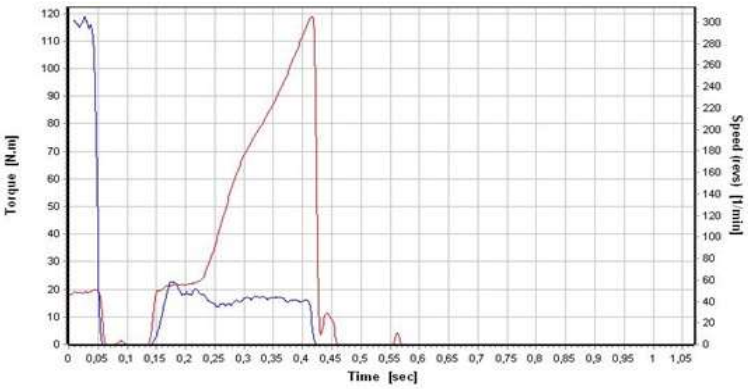
Value no. 1
Graph
Torque / Angle / Speed



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:** 756057

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: 0,86 % ± **0,43 %**

Angle degree: 180° Tolerance: 2,4° ± **1,2°**

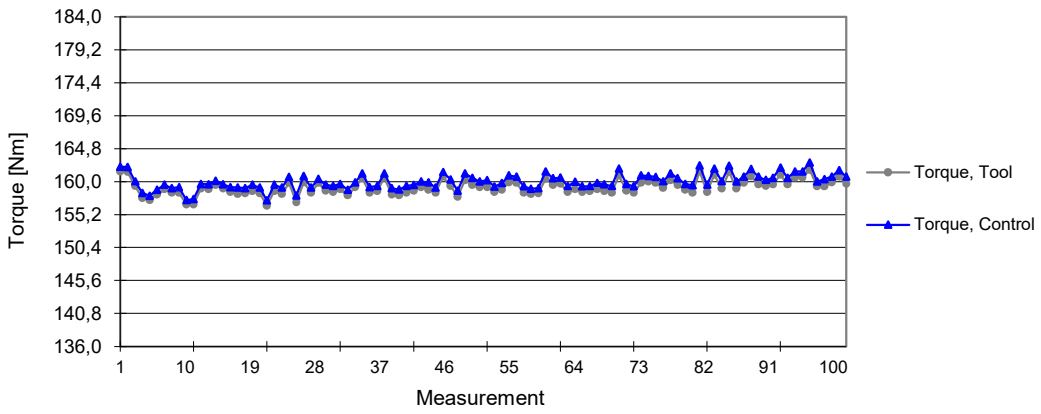
Formula derivation: $C_m = \frac{T}{6\,s}$ $T = C_m * 6\,s$

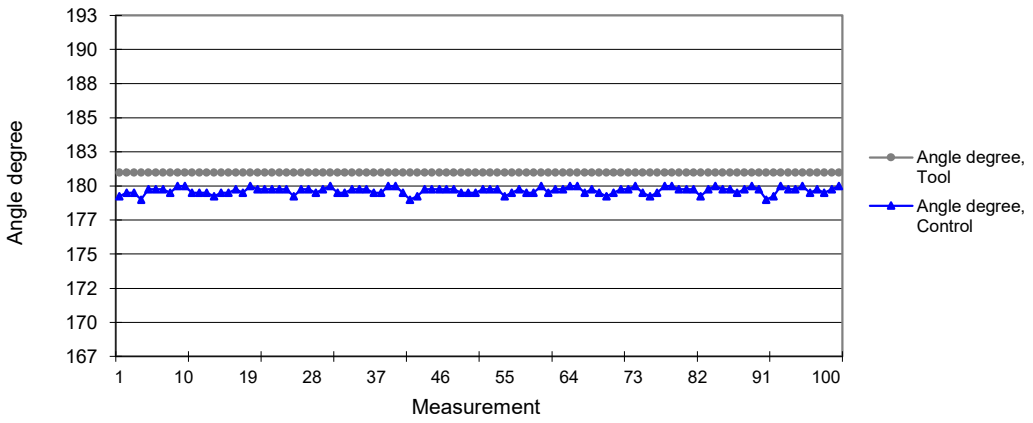
Tool without angle correction

Measurement	Tool data		Control data		Difference	
No.	Torque	Angle	Torque	Angle	Torque	Angle
1	161,50	181,00	162,17	179,25	0,67	1,75
2	161,40	181,00	162,12	179,50	0,72	1,50
3	159,40	181,00	160,06	179,50	0,66	1,50
4	157,60	181,00	158,36	179,00	0,76	2,00
5	157,30	181,00	157,91	179,75	0,61	1,25
6	158,10	181,00	158,81	179,75	0,71	1,25
7	158,90	181,00	159,56	179,75	0,66	1,25
8	158,40	181,00	159,06	179,50	0,66	1,50
9	158,40	181,00	159,21	180,00	0,81	1,00
10	156,70	181,00	157,31	180,00	0,61	1,00
11	156,70	181,00	157,46	179,50	0,76	1,50
12	159,00	181,00	159,66	179,50	0,66	1,50
13	158,90	181,00	159,61	179,50	0,71	1,50
14	159,50	181,00	160,11	179,25	0,61	1,75
15	159,00	181,00	159,61	179,50	0,61	1,50
16	158,50	181,00	159,21	179,50	0,71	1,50
17	158,20	181,00	159,16	179,75	0,96	1,25
18	158,30	181,00	159,06	179,50	0,76	1,50
19	158,60	181,00	159,56	180,00	0,96	1,00
20	158,30	181,00	159,11	179,75	0,81	1,25
21	156,50	181,00	157,26	179,75	0,76	1,25
22	158,60	181,00	159,56	179,75	0,96	1,25
23	158,20	181,00	159,11	179,75	0,91	1,25
24	159,80	181,00	160,66	179,75	0,86	1,25
25	157,00	181,00	157,96	179,25	0,96	1,75
26	159,90	181,00	160,81	179,75	0,91	1,25
27	158,40	181,00	159,11	179,75	0,71	1,25
28	159,80	181,00	160,41	179,50	0,61	1,50
29	158,70	181,00	159,56	179,75	0,86	1,25
30	158,50	181,00	159,41	180,00	0,91	1,00
31	158,90	181,00	159,66	179,50	0,76	1,50
32	158,00	181,00	158,81	179,50	0,81	1,50
33	159,20	181,00	159,91	179,75	0,71	1,25
34	160,50	181,00	161,22	179,75	0,72	1,25
35	158,40	181,00	159,21	179,75	0,81	1,25
36	158,60	181,00	159,41	179,50	0,81	1,50
37	160,60	181,00	161,22	179,50	0,62	1,50
38	158,10	181,00	159,06	180,00	0,96	1,00
39	158,00	181,00	158,86	180,00	0,86	1,00
40	158,40	181,00	159,41	179,50	1,01	1,50
41	158,70	181,00	159,51	179,00	0,81	2,00
42	159,20	181,00	160,01	179,25	0,81	1,75
43	158,80	181,00	159,91	179,75	1,11	1,25
44	158,40	181,00	159,11	179,75	0,71	1,25
45	160,70	181,00	161,42	179,75	0,72	1,25
46	159,40	181,00	160,31	179,75	0,91	1,25
47	157,80	181,00	158,71	179,75	0,91	1,25
48	160,20	181,00	161,17	179,50	0,97	1,50
49	159,50	181,00	160,56	179,50	1,06	1,50
50	159,20	181,00	160,01	179,50	0,81	1,50
51	159,20	181,00	160,21	179,75	1,01	1,25
52	158,50	181,00	159,26	179,75	0,76	1,25
53	158,80	181,00	159,76	179,75	0,96	1,25
54	159,90	181,00	160,91	179,25	1,01	1,75
55	159,80	181,00	160,76	179,50	0,96	1,50
56	158,40	181,00	159,31	179,75	0,91	1,25
57	158,20	181,00	158,96	179,50	0,76	1,50
58	158,30	181,00	159,06	179,50	0,76	1,50
59	160,40	181,00	161,47	180,00	1,07	1,00
60	159,50	181,00	160,46	179,50	0,96	1,50
61	159,70	181,00	160,61	179,75	0,91	1,25
62	158,50	181,00	159,36	179,75	0,86	1,25
63	158,90	181,00	159,96	180,00	1,06	1,00
64	158,50	181,00	159,31	180,00	0,81	1,00
65	158,60	181,00	159,36	179,50	0,76	1,50
66	158,90	181,00	159,81	179,75	0,91	1,25
67	158,60	181,00	159,61	179,50	1,01	1,50
68	158,40	181,00	159,36	179,25	0,96	1,75
69	160,90	181,00	161,92	179,50	1,02	1,50
70	158,70	181,00	159,66	179,75	0,96	1,25
71	158,40	181,00	159,31	179,75	0,91	1,25
72	159,80	181,00	160,91	180,00	1,11	1,00
73	160,00	181,00	160,81	179,50	0,81	1,50
74	159,80	181,00	160,66	179,25	0,86	1,75
75	159,10	181,00	160,06	179,50	0,96	1,50
76	160,20	181,00	161,22	180,00	1,02	1,00
77	159,50	181,00	160,51	180,00	1,01	1,00
78	158,80	181,00	159,66	179,75	0,86	1,25
79	158,40	181,00	159,46	179,75	1,06	1,25
80	161,50	181,00	162,37	179,75	0,87	1,25
81	158,50	181,00	159,56	179,25	1,06	1,75
82	161,00	181,00	161,92	179,75	0,92	1,25
83	159,00	181,00	160,06	180,00	1,06	1,00
84	161,40	181,00	162,32	179,75	0,92	1,25
85	159,00	181,00	160,01	179,75	1,01	1,25
86	159,80	181,00	160,76	179,50	0,96	1,50
87	160,80	181,00	161,82	179,75	1,02	1,25
88	159,60	181,00	160,71	180,00	1,11	1,00
89	159,40	181,00	160,26	179,75	0,86	1,25
90	159,60	181,00	160,56	179,00	0,96	2,00
91	161,00	181,00	162,02	179,25	1,02	1,75
92	159,60	181,00	160,56	180,00	0,96	1,00
93	160,60	181,00	161,47	179,75	0,87	1,25
94	160,60	181,00	161,47	179,75	0,87	1,25
95	161,70	181,00	162,77	180,00	1,07	1,00
96	159,30	181,00	160,01	179,50	0,71	1,50
97	159,30	181,00	160,36	179,75	1,06	1,25
98	159,90	181,00	160,76	179,50	0,86	1,50
99	160,70	181,00	161,67	179,75	0,97	1,25
100	159,70	181,00	160,71	180,00	1,01	1,00
				Standard deviation:	**0,137**	**0,244**

Graphical representation

Model:	**2BD-2B200A-2K3D-2ZB**	Serial no:	**756057**
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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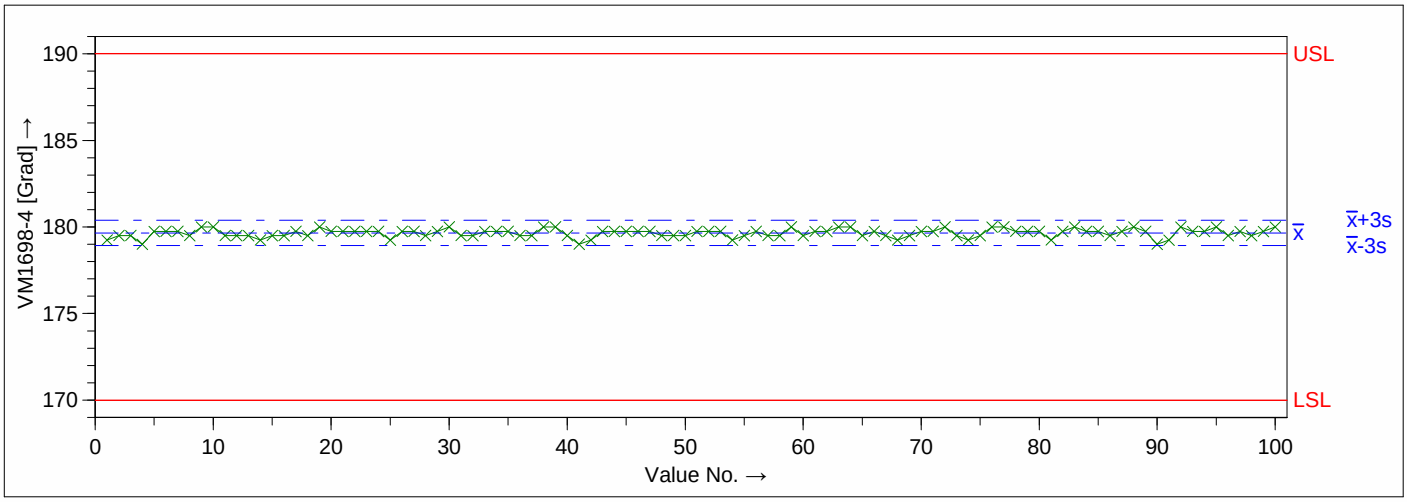
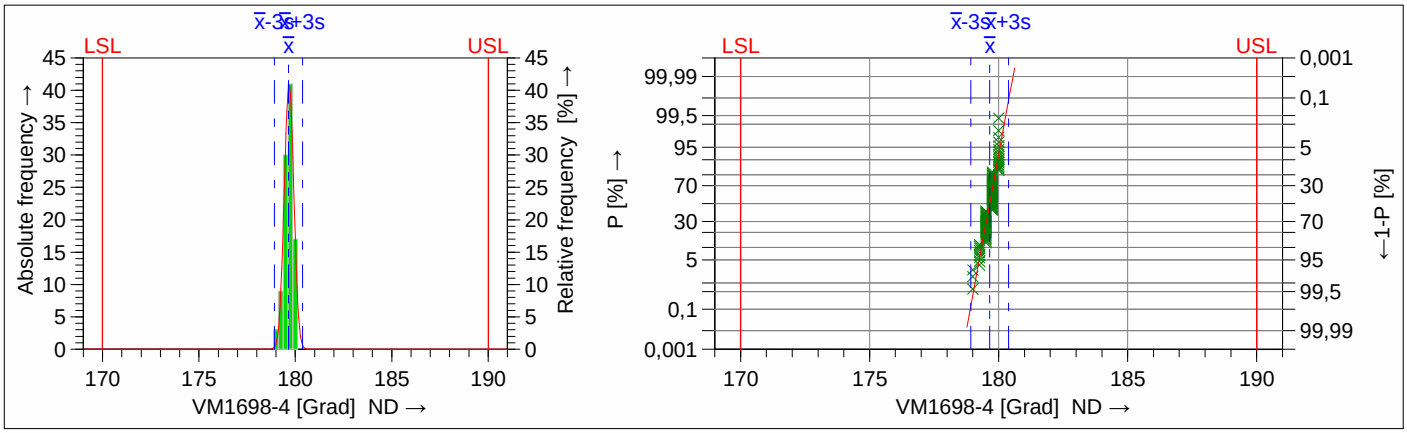
Plant	ATG Westhausen	Operator Name	Sünder
Date	29.04.2022		

Ord. No.	2BD200T1S-A	Part type	2BD-2B200A-2K3D-2ZB	Contr.item	yes
Serial No.	756057_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 29.04.2022 09:27:12 to 29.04.2022 09:42:36

Rem. TQ 80% Angle 180° +/-10° * TQ-Cal.: 200 Nm; Cur-Cal.: 5.513 Nm/A; Speed: 300/50 rpm;





Drawing Values		Collected Values		Statistics	
T_m	180.00			$\bar{x}$	179.6500
LSL	170.00	x_{min}	179.00	$\bar{x}$-3s	178.9192
USL	190.00	x_{max}	180.00	$\bar{x}$+3s	180.3808
T	20.00	R	1.00	6s	1.4616
		$n_{<T>}$	100	$p_{<T>}$	100.00000 %
		$n_{>USL}$	0	$p_{>USL}$	0.00000%
		$n_{<LSL}$	0	$p_{<LSL}$	0.00000%
		n_{eff}	100		
		n_{tot}	100		

Model distribution		Normal Distribution	
Calculation method		M1.1.4 $\hat{\sigma} = S_{tot}$	
Potential Capability index	=	C_m	13.68
Critical capability index	=	C_{mk}	13.20

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

APEX VDI/VDE 2647 V0.1

Machine Capability Study
Control System

Plant	ATG Westhausen		Operator Name	Sünder	Date 29.04.2022

Serial No.	756057_I	Characteristic			
Part type	2BD-2B200A-2K3D-2ZB	Char.Descr.	VM1698-4	Nom.val.	159,40
Ord. No.	2BD200T1S-A	Serial No.	1024210	LSL	124,40
				USL	195,96
Remark	TQ 80% Angle 180°+/-10°* TQ-Cal.: 200 Nm; C ur-Cal.: 5.513 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	162,12	160,06	158,36	157,91	158,81	159,56	159,06	159,21	157,31
1024210	VM1698-4	Grad	179,25	179,50	179,50	179,00	179,75	179,75	179,75	179,50	180,00	180,00

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	157,46	159,66	159,61	160,11	159,61	159,21	159,16	159,06	159,56	159,11
1024210	VM1698-4	Grad	179,50	179,50	179,50	179,25	179,50	179,50	179,75	179,50	180,00	179,75

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	157,26	159,56	159,11	160,66	157,96	160,81	159,11	160,41	159,56	159,41
1024210	VM1698-4	Grad	179,75	179,75	179,75	179,75	179,25	179,75	179,75	179,50	179,75	180,00

Char.No.	Char.Descr.	Unit	x_{31}	x_{32}	x_{33}	x_{34}	x_{35}	x_{36}	x_{37}	x_{38}	x_{39}	x_{40}
1024210	VM1698-4	Nm	159,66	158,81	159,91	161,22	159,21	159,41	161,22	159,06	158,86	159,41
1024210	VM1698-4	Grad	179,50	179,50	179,75	179,75	179,75	179,50	179,50	180,00	180,00	179,50

Char.No.	Char.Descr.	Unit	x_{41}	x_{42}	x_{43}	x_{44}	x_{45}	x_{46}	x_{47}	x_{48}	x_{49}	x_{50}
1024210	VM1698-4	Nm	159,51	160,01	159,91	159,11	161,42	160,31	158,71	161,17	160,56	160,01
1024210	VM1698-4	Grad	179,00	179,25	179,75	179,75	179,75	179,75	179,75	179,50	179,50	179,50

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	160,21	159,26	159,76	160,91	160,76	159,31	158,96	159,06	161,47	160,46
1024210	VM1698-4	Grad	179,75	179,75	179,75	179,25	179,50	179,75	179,50	179,50	180,00	179,50

Char.No.	Char.Descr.	Unit	x_{61}	x_{62}	x_{63}	x_{64}	x_{65}	x_{66}	x_{67}	x_{68}	x_{69}	x_{70}
1024210	VM1698-4	Nm	160,61	159,36	159,96	159,31	159,36	159,81	159,61	159,36	161,92	159,66
1024210	VM1698-4	Grad	179,75	179,75	180,00	180,00	179,50	179,75	179,50	179,25	179,50	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	159,31	160,91	160,81	160,66	160,06	161,22	160,51	159,66	159,46	162,37
1024210	VM1698-4	Grad	179,75	180,00	179,50	179,25	179,50	180,00	180,00	179,75	179,75	179,75

Machine Capability Study
Control System

Plant	ATG Westhausen		Operator Name	Sünder	Date 29.04.2022

Serial No.	756057_I	Characteristic			
Part type	2BD-2B200A-2K3D-2ZB	Char.Descr.	VM1698-4	Nom.val.	159,40
Ord. No.	2BD200T1S-A	Serial No.	1024210	LSL	124,40
				USL	195,96
Remark	TQ 80% Angle 180°+/-10°* TQ-Cal.: 200 Nm; C ur-Cal.: 5.513 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	159,56	161,92	160,06	162,32	160,01	160,76	161,82	160,71	160,26	160,56
1024210	VM1698-4	Grad	179,25	179,75	180,00	179,75	179,75	179,50	179,75	180,00	179,75	179,00

Char.No.	Char.Descr.	Unit	x_{91}	x_{92}	x_{93}	x_{94}	x_{95}	x_{96}	x_{97}	x_{98}	x_{99}	x_{100}
1024210	VM1698-4	Nm	162,02	160,56	161,47	161,47	162,77	160,01	160,36	160,76	161,67	160,71
1024210	VM1698-4	Grad	179,25	180,00	179,75	179,75	180,00	179,50	179,75	179,50	179,75	180,00

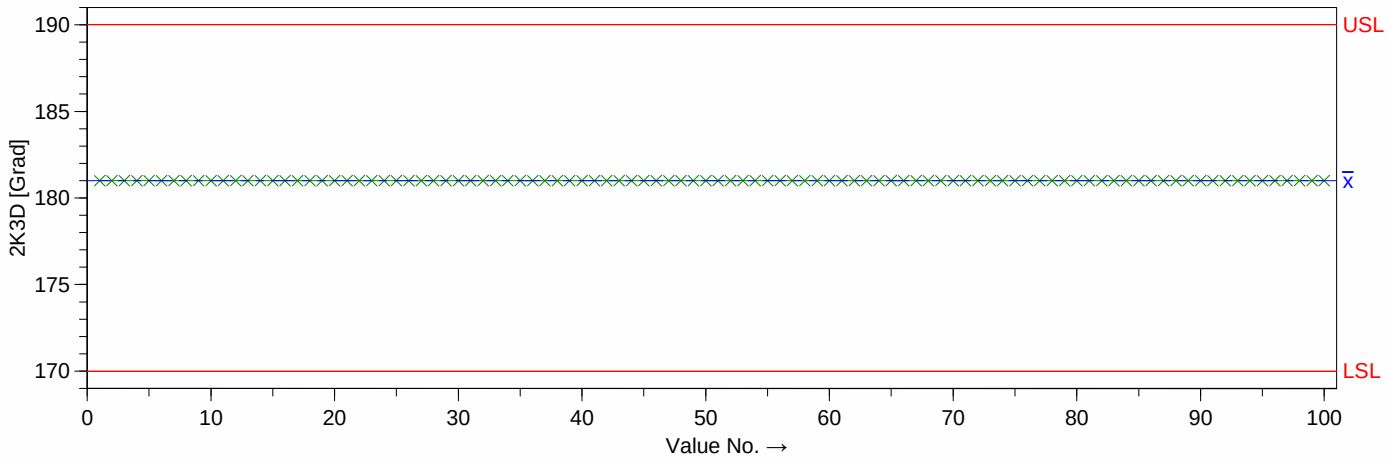
Machine Capability Study
Tool System

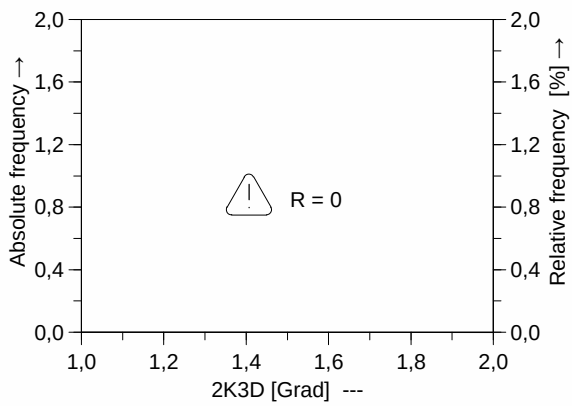
Plant	ATG Westhausen	Operator Name	Sünder
Date	29.04.2022		

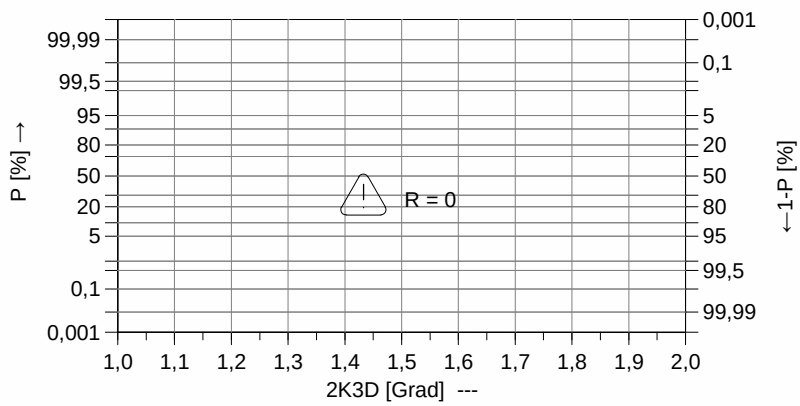
Ord. No.	2BD200T1S-A	Part type	2BD-2B200A-2K3D-2ZB	Contr.item	yes
Serial No.	756057_l	Char.Descr.	2K3D	Nom.val. 180,00 10,00	USL 190,00
		Serial No.	206285	Unit Grad -10,00	LSL 170,00
Char.Type	variable			Tolerance value 6 %	Decimal Pl. 2
Cust.Name	Cleco	Reference System	VM1698-4	Test Electronic	MPRO400GCD-P
Contr.No.	Homologation	Reference Transducer	250 / 5537037	nges.	100

Evaluation from 29.04.2022 09:27:14 to 29.04.2022 09:42:37

Rem. TQ 80% Angle 180° +/-10° * TQ-Cal.: 200 Nm; Cur-Cal.: 5.513 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 29.04.2022

Serial No.	756057_I	Characteristic			
Part type	2BD-2B200A-2K3D-2ZB	Char.Descr.	2K3D	Nom.val.	81,65
Ord. No.	2BD200T1S-A	Serial No.	206285	LSL	0,00
				USL	195,96
Remark	TQ 80% Angle 180°+/-10°* TQ-Cal.: 200 Nm; C ur-Cal.: 5.513 Nm/A; Speed: 300/50 rpm;				

Char.No.	Char.Descr.	Unit	x_1	x_2	x_3	x_4	x_5	x_6	x_7	x_8	x_9	x_{10}
206285	2K3D	Nm	161,50	161,40	159,40	157,60	157,30	158,10	158,90	158,40	158,40	156,70
206285	2K3D	Grad	181,00	181,00	181,00	181,00	181,00	181,00	181,00	181,00	181,00	181,00

Char.No.	Char.Descr.	Unit	x_{11}	x_{12}	x_{13}	x_{14}	x_{15}	x_{16}	x_{17}	x_{18}	x_{19}	x_{20}
206285	2K3D	Nm	156,70	159,00	158,90	159,50	159,00	158,50	158,20	158,30	158,60	158,30
206285	2K3D	Grad	181,00	181,00	181,00	181,00	181,00	181,00	181,00	181,00	181,00	181,00

Char.No.	Char.Descr.	Unit	x_{21}	x_{22}	x_{23}	x_{24}	x_{25}	x_{26}	x_{27}	x_{28}	x_{29}	x_{30}
206285	2K3D	Nm	156,50	158,60	158,20	159,80	157,00	159,90	158,40	159,80	158,70	158,50
206285	2K3D	Grad	181,00	181,00	181,00	181,00	181,00	181,00	181,00	181,00	181,00	181,00

Char.No.	Char.Descr.	Unit	x_{31}	x_{32}	x_{33}	x_{34}	x_{35}	x_{36}	x_{37}	x_{38}	x_{39}	x_{40}
206285	2K3D	Nm	158,90	158,00	159,20	160,50	158,40	158,60	160,60	158,10	158,00	158,40
206285	2K3D	Grad	181,00	181,00	181,00	181,00	181,00	181,00	181,00	181,00	181,00	181,00

Char.No.	Char.Descr.	Unit	x_{41}	x_{42}	x_{43}	x_{44}	x_{45}	x_{46}	x_{47}	x_{48}	x_{49}	x_{50}
206285	2K3D	Nm	158,70	159,20	158,80	158,40	160,70	159,40	157,80	160,20	159,50	159,20
206285	2K3D	Grad	181,00	181,00	181,00	181,00	181,00	181,00	181,00	181,00	181,00	181,00

Char.No.	Char.Descr.	Unit	x_{51}	x_{52}	x_{53}	x_{54}	x_{55}	x_{56}	x_{57}	x_{58}	x_{59}	x_{60}
206285	2K3D	Nm	159,20	158,50	158,80	159,90	159,80	158,40	158,20	158,30	160,40	159,50
206285	2K3D	Grad	181,00	181,00	181,00	181,00	181,00	181,00	181,00	181,00	181,00	181,00

Char.No.	Char.Descr.	Unit	x_{61}	x_{62}	x_{63}	x_{64}	x_{65}	x_{66}	x_{67}	x_{68}	x_{69}	x_{70}
206285	2K3D	Nm	159,70	158,50	158,90	158,50	158,60	158,90	158,60	158,40	160,90	158,70
206285	2K3D	Grad	181,00	181,00	181,00	181,00	181,00	181,00	181,00	181,00	181,00	181,00

Char.No.	Char.Descr.	Unit	x_{71}	x_{72}	x_{73}	x_{74}	x_{75}	x_{76}	x_{77}	x_{78}	x_{79}	x_{80}
206285	2K3D	Nm	158,40	159,80	160,00	159,80	159,10	160,20	159,50	158,80	158,40	161,50
206285	2K3D	Grad	181,00	181,00	181,00	181,00	181,00	181,00	181,00	181,00	181,00	181,00

Machine Capability Study
Tool System

Plant	ATG Westhausen		Operator Name	Sünder	Date 29.04.2022

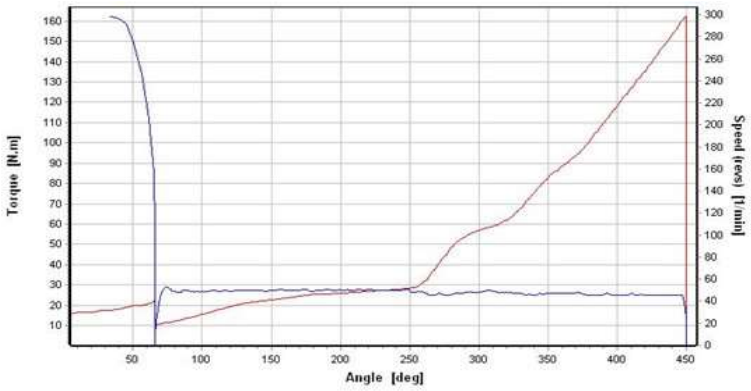
Serial No.	756057_I	Characteristic			
Part type	2BD-2B200A-2K3D-2ZB	Char.Descr.	2K3D	Nom.val.	81,65
Ord. No.	2BD200T1S-A	Serial No.	206285	LSL	0,00
				USL	195,96
Remark	TQ 80% Angle 180°+/-10°* TQ-Cal.: 200 Nm; C ur-Cal.: 5.513 Nm/A; Speed: 300/50 rpm;				

Char.No.	Char.Descr.	Unit	x_{81}	x_{82}	x_{83}	x_{84}	x_{85}	x_{86}	x_{87}	x_{88}	x_{89}	x_{90}
206285	2K3D	Nm	158,50	161,00	159,00	161,40	159,00	159,80	160,80	159,60	159,40	159,60
206285	2K3D	Grad	181,00	181,00	181,00	181,00	181,00	181,00	181,00	181,00	181,00	181,00

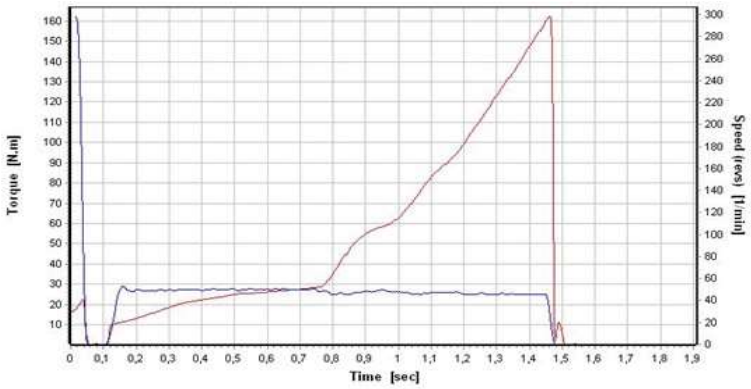
Char.No.	Char.Descr.	Unit	x_{91}	x_{92}	x_{93}	x_{94}	x_{95}	x_{96}	x_{97}	x_{98}	x_{99}	x_{100}
206285	2K3D	Nm	161,00	159,60	160,60	160,60	161,70	159,30	159,30	159,90	160,70	159,70
206285	2K3D	Grad	181,00	181,00	181,00	181,00	181,00	181,00	181,00	181,00	181,00	181,00

Torque graphs

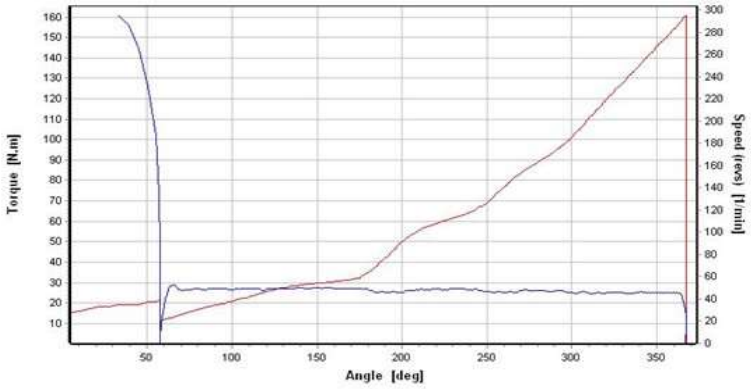
Model:	**2BD-2B200A-2K3D-2ZB**	Serial no:	**756057**
Target torque:	**160,00 Nm**	80 % of max. torque	
Angle degree:	**180°**	Tool without angle correction	



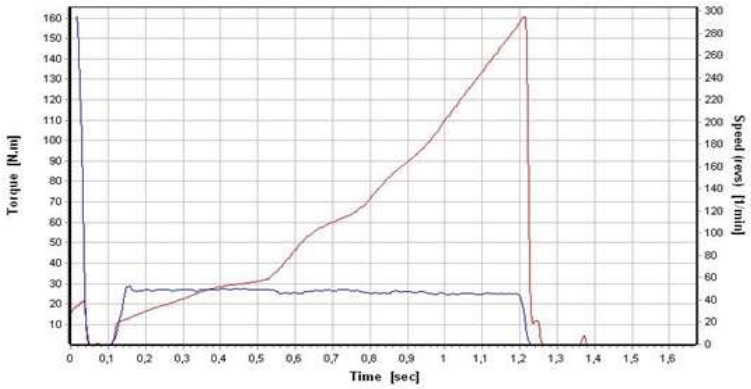
Value no. 1
Graph
Torque / Angle / Speed



Value no. 1
Graph
Torque / Time / Speed



Value no. 100
Graph
Torque / Angle / Speed



Value no. 100
Graph
Torque / Time / Speed