Homologation

Fixtured Spindle

Model: 1BD-1B060A-1K2D-1VK2D

Serial no.: 756029

Contents

Homologation: 1BD-1B060A-1K2D-1VK2D SN: 756029

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Test sheet no. 2

Machine Capability Study 30 %

Multi-stage tightening system	☑	Speed 50 rpm	7,1 %
Single-stage tightening system	☐	Speed 100 %	700 rpm

Manufacturer: Apex Tool Group Serial no: **756029**

Test torque: Tq min. + 0.3 (Tq max. - Tq min.) 19,61 Nm

Hard joint (H)	118,93 Nm / Revolution	Angle degree	30°
Soft joint (L)	9,84 Nm / Revolution	Angle degree	360°

		H	L
a)	Tolerance down / up	18,24 20,98 Nm	18,24 - 20,98 Nm
	Tolerance down / up	7	7 %
	Average torque	19,82	19,67 Nm
	Standard deviation	0,09	0,06 Nm
	Torque scatter (99,73%)	0,56	0,35 Nm
	C_m	4,89	7,76
	C_{mk}	4,13	7,41

b) Min. C_m hard/soft (lowest value) 4,89
Min. C_{mk} hard/soft (lowest value) 4,13

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

Note:

Machine Capability Study
Control System

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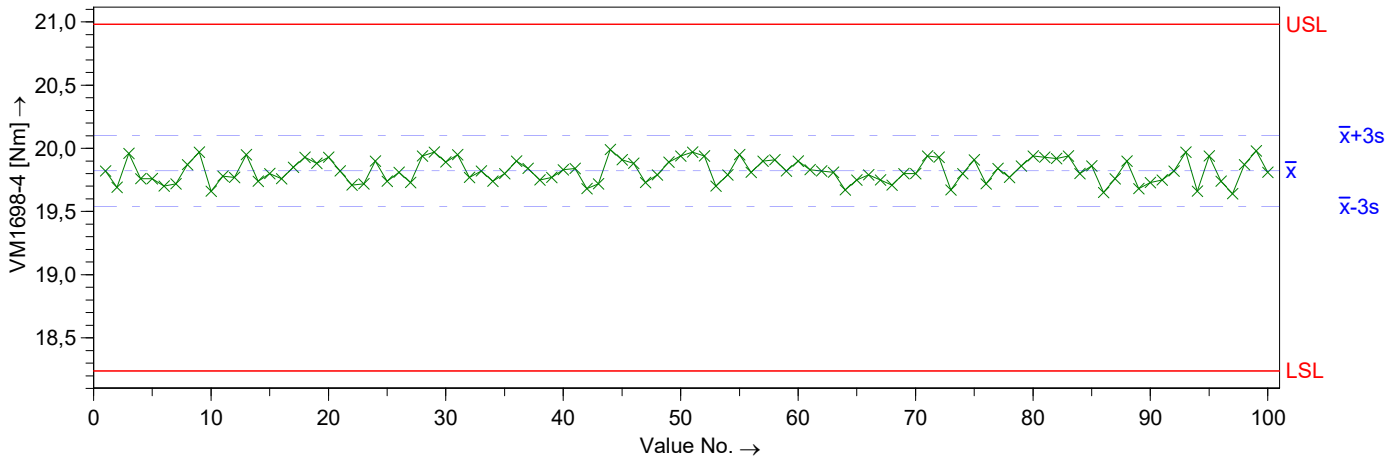
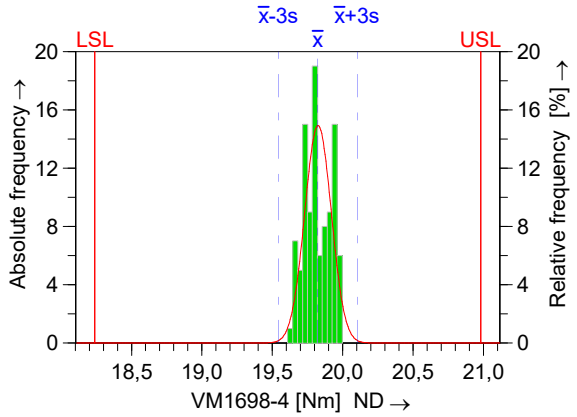
Plant	ATG Westhausen	Operator Name	Sünder
Date	03.02.2022		

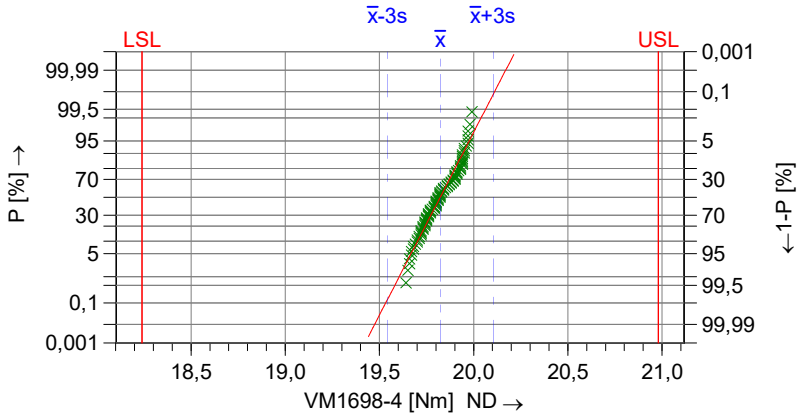
Ord. No.	1BD53T2O-A	Part type	1BD-1B060A-1K2D-1VK2D	Contr.item	yes
Serial No.	756029_d	Char.Descr.	VM1698-4	Inspection Val. 19,61 1,37	USL 20,98
		Serial No.	1024210	Unit Nm -1,37	LSL 18,24
Char.Type	variable			Tolerance value 7 %	Decimal Pl. 2
Cust.Name	Cleco	Reference System	VM1698-4	Test Electronic	MPRO400GCD-P
Contr.No.	Homologation	Reference Transducer	50 / 1024729	nges.	100

Evaluation from 03.02.2022 14:00:29 to 03.02.2022 14:14:17

Rem. TQ 30% hard +/-7% * TQ-Cal.: 60.0 Nm; Cur-Cal.: 3.8391 Nm/A; Speed: 700/50 rpm;







Drawing Values		Collected Values		Statistics	
T_m	19.61			$\bar{x}$	19.8222
LSL	18.24	x_{min}	19.64	$\bar{x}$-3s	19.5418
USL	20.98	x_{max}	19.99	$\bar{x}$+3s	20.1026
T	2.74	R	0.35	6s	0.5608
		$n_{<T>}$	100	$p_{<T>}$	100.00000 %
		$n_{>USL}$	0	$p_{>USL}$	0.00000%
		$n_{<LSL}$	0	$p_{<LSL}$	0.00000%
		n_{eff}	100		
		n_{tot}	100		

Model distribution			Normal Distribution
Calculation method			$M1_{1.4}$ $\hat{\sigma} = s_{tot}$
Potential Capability index	=	C_m	4.89
Critical capability index	=	C_{mk}	4.13

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

APEX VDI/VDE 2647 V0.1

Apex Tool Group GmbH \\htwe0006\AppData\QW\QWE\MessWert\2022\756029_dM.DFD

Machine Capability Study
Control System

Plant	ATG Westhausen		Operator Name	Sünder	Date 03.02.2022

Ser.No.	756029_d	Characteristic			
Type	1BD-1B060A-1K2D-1VK2D	Char.Descr.	VM1698-4	Inspection Val.	19,61
Ord. No.	1BD53T2O-A	Ser.No.	1024210	LSL	18,24
				USL	20,98
Remark	TQ 30% hard +/-7% * TQ-Cal.: 60.0 Nm; Cur-Cal.: 3.8391 Nm/A; Speed: 700/50 rpm;				

Char.No.	Char.Descr.	x_1	x_2	x_3	x_4	x_5	x_6	x_7	x_8	x_9	x_{10}
1024210	VM1698-4	19,82	19,69	19,96	19,76	19,76	19,70	19,72	19,87	19,97	19,66
1024210	VM1698-4	31,25	30,50	31,25	30,75	30,50	31,00	30,75	31,00	30,50	30,75

Char.No.	Char.Descr.	x_{11}	x_{12}	x_{13}	x_{14}	x_{15}	x_{16}	x_{17}	x_{18}	x_{19}	x_{20}
1024210	VM1698-4	19,78	19,77	19,95	19,74	19,80	19,76	19,85	19,93	19,88	19,93
1024210	VM1698-4	30,75	31,00	30,75	30,25	30,50	30,00	30,50	30,50	30,25	30,25

Char.No.	Char.Descr.	x_{21}	x_{22}	x_{23}	x_{24}	x_{25}	x_{26}	x_{27}	x_{28}	x_{29}	x_{30}
1024210	VM1698-4	19,82	19,71	19,72	19,90	19,74	19,81	19,73	19,94	19,97	19,89
1024210	VM1698-4	30,00	30,25	30,25	30,25	29,75	30,25	30,25	30,75	30,75	30,25

Char.No.	Char.Descr.	x_{31}	x_{32}	x_{33}	x_{34}	x_{35}	x_{36}	x_{37}	x_{38}	x_{39}	x_{40}
1024210	VM1698-4	19,95	19,77	19,82	19,74	19,80	19,90	19,84	19,75	19,77	19,83
1024210	VM1698-4	30,00	30,00	30,25	30,25	29,75	30,00	30,25	30,25	30,25	30,00

Char.No.	Char.Descr.	x_{41}	x_{42}	x_{43}	x_{44}	x_{45}	x_{46}	x_{47}	x_{48}	x_{49}	x_{50}
1024210	VM1698-4	19,84	19,68	19,72	19,99	19,91	19,88	19,73	19,79	19,89	19,94
1024210	VM1698-4	30,25	30,00	30,00	30,75	30,50	30,25	29,75	30,25	30,25	30,50

Char.No.	Char.Descr.	x_{51}	x_{52}	x_{53}	x_{54}	x_{55}	x_{56}	x_{57}	x_{58}	x_{59}	x_{60}
1024210	VM1698-4	19,97	19,94	19,70	19,79	19,95	19,81	19,90	19,91	19,82	19,90
1024210	VM1698-4	30,75	30,00	30,00	30,00	30,25	30,00	30,00	30,00	30,25	30,25

Char.No.	Char.Descr.	x_{61}	x_{62}	x_{63}	x_{64}	x_{65}	x_{66}	x_{67}	x_{68}	x_{69}	x_{70}
1024210	VM1698-4	19,83	19,82	19,81	19,67	19,75	19,79	19,75	19,71	19,80	19,80
1024210	VM1698-4	30,50	29,75	30,00	30,00	30,25	30,25	29,75	29,75	30,00	30,00

Char.No.	Char.Descr.	x_{71}	x_{72}	x_{73}	x_{74}	x_{75}	x_{76}	x_{77}	x_{78}	x_{79}	x_{80}
1024210	VM1698-4	19,94	19,93	19,67	19,80	19,91	19,72	19,84	19,77	19,86	19,94
1024210	VM1698-4	30,50	30,75	30,00	29,75	30,50	29,75	29,75	30,25	30,25	30,25

Machine Capability Study
Control System

Plant	ATG Westhausen		Operator Name	Sünder	Date 03.02.2022

Ser.No.	756029_d	Characteristic			
Type	1BD-1B060A-1K2D-1VK2D	Char.Descr.	VM1698-4	Inspection Val.	19,61
Ord. No.	1BD53T2O-A	Ser.No.	1024210	LSL	18,24
				USL	20,98
Remark	TQ 30% hard +/-7% * TQ-Cal.: 60.0 Nm; Cur-Cal.: 3.8391 Nm/A; Speed: 700/50 rpm;				

Char.No.	Char.Descr.	x_{81}	x_{82}	x_{83}	x_{84}	x_{85}	x_{86}	x_{87}	x_{88}	x_{89}	x_{90}
1024210	VM1698-4	19,93	19,92	19,94	19,80	19,86	19,65	19,76	19,90	19,68	19,73
1024210	VM1698-4	30,50	30,50	30,00	30,50	30,25	29,75	30,25	30,25	30,00	30,00

Char.No.	Char.Descr.	x_{91}	x_{92}	x_{93}	x_{94}	x_{95}	x_{96}	x_{97}	x_{98}	x_{99}	x_{100}
1024210	VM1698-4	19,75	19,82	19,97	19,66	19,94	19,74	19,64	19,87	19,98	19,81
1024210	VM1698-4	30,25	30,25	30,00	30,00	30,50	30,00	29,50	30,00	30,00	29,75

Machine Capability Study
Tool System

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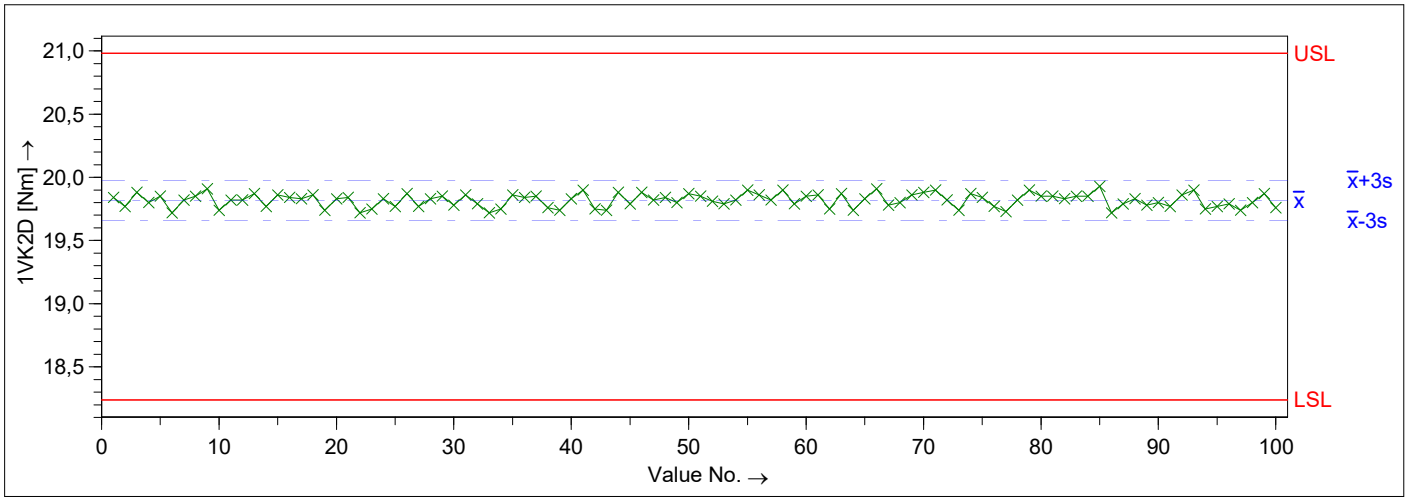
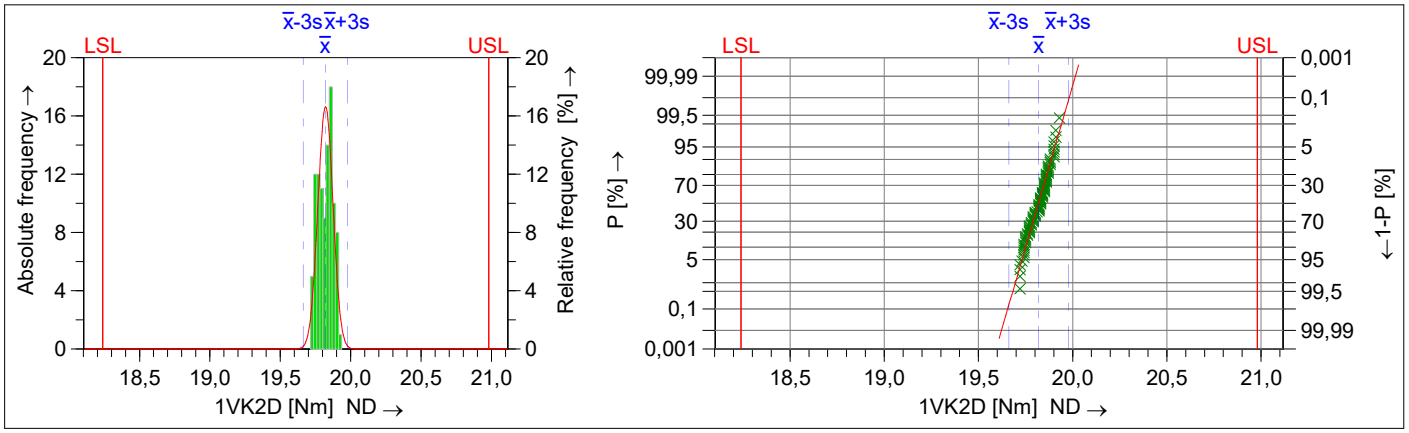
Plant	ATG Westhausen	Operator Name	Sünder
Date	03.02.2022		

Ord. No.	1BD53T2O-A	Part type	1BD-1B060A-1K2D-1VK2D	Contr.item	yes
Serial No.	756029_d	Char.Descr.	1VK2D	Inspection Val. 19,61 1,37	USL 20,98
		Serial No.	200694_1	Unit Nm -1,37	LSL 18,24
Char.Type	variable			Tolerance value 7 %	Decimal Pl. 2
Cust.Name	Cleco	Reference System	VM1698-4	Test Electronic	MPRO400GCD-P
Contr.No.	Homologation	Reference Transducer	50 / 1024729	nges.	100

Evaluation from 03.02.2022 14:00:29 to 03.02.2022 14:14:18

Rem. TQ 30% hard +/-7% * TQ-Cal.: 60.0 Nm; Cur-Cal.: 3.8391 Nm/A; Speed: 700/50 rpm;





Drawing Values		Collected Values		Statistics	
T_m	19.61			$\bar{x}$	19.8185
LSL	18.24	x_{min}	19.72	$\bar{x}$-3s	19.6603
USL	20.98	x_{max}	19.93	$\bar{x}$+3s	19.9767
T	2.74	R	0.21	6s	0.3164
		$n_{<T>}$	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	8.66
Critical capability index	=	C_{mk}	7.34

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

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Machine Capability Study
Tool System

Plant	ATG Westhausen		Operator Name	Sünder	Date 03.02.2022

Ser.No.	756029_d	Characteristic			
Type	1BD-1B060A-1K2D-1VK2D	Char.Descr.	1VK2D	Inspection Val.	19,61
Ord. No.	1BD53T2O-A	Ser.No.	200694_1	LSL	18,24
				USL	20,98
Remark	TQ 30% hard +/-7% * TQ-Cal.: 60.0 Nm; Cur-Cal.: 3.8391 Nm/A; Speed: 700/50 rpm;				

Char.No.	Char.Descr.	x_1	x_2	x_3	x_4	x_5	x_6	x_7	x_8	x_9	x_{10}
200694_	1VK2D	19,84	19,77	19,88	19,80	19,85	19,72	19,82	19,85	19,91	19,74
200694_	1VK2D	31,00	30,00	31,00	30,00	30,00	30,00	30,00	31,00	30,00	30,00

Char.No.	Char.Descr.	x_{11}	x_{12}	x_{13}	x_{14}	x_{15}	x_{16}	x_{17}	x_{18}	x_{19}	x_{20}
200694_	1VK2D	19,82	19,82	19,87	19,77	19,86	19,84	19,83	19,86	19,74	19,83
200694_	1VK2D	31,00	31,00	30,00	30,00	30,00	30,00	30,00	30,00	30,00	30,00

Char.No.	Char.Descr.	x_{21}	x_{22}	x_{23}	x_{24}	x_{25}	x_{26}	x_{27}	x_{28}	x_{29}	x_{30}
200694_	1VK2D	19,84	19,72	19,75	19,83	19,77	19,87	19,77	19,83	19,85	19,78
200694_	1VK2D	29,00	30,00	30,00	30,00	29,00	30,00	30,00	30,00	30,00	30,00

Char.No.	Char.Descr.	x_{31}	x_{32}	x_{33}	x_{34}	x_{35}	x_{36}	x_{37}	x_{38}	x_{39}	x_{40}
200694_	1VK2D	19,86	19,79	19,72	19,75	19,86	19,84	19,85	19,76	19,74	19,83
200694_	1VK2D	30,00	30,00	30,00	29,00	29,00	30,00	30,00	30,00	29,00	29,00

Char.No.	Char.Descr.	x_{41}	x_{42}	x_{43}	x_{44}	x_{45}	x_{46}	x_{47}	x_{48}	x_{49}	x_{50}
200694_	1VK2D	19,90	19,75	19,74	19,88	19,79	19,88	19,82	19,84	19,80	19,87
200694_	1VK2D	30,00	30,00	30,00	30,00	30,00	30,00	30,00	30,00	30,00	30,00

Char.No.	Char.Descr.	x_{51}	x_{52}	x_{53}	x_{54}	x_{55}	x_{56}	x_{57}	x_{58}	x_{59}	x_{60}
200694_	1VK2D	19,85	19,81	19,79	19,82	19,90	19,86	19,82	19,90	19,79	19,85
200694_	1VK2D	30,00	30,00	30,00	30,00	30,00	30,00	30,00	30,00	30,00	30,00

Char.No.	Char.Descr.	x_{61}	x_{62}	x_{63}	x_{64}	x_{65}	x_{66}	x_{67}	x_{68}	x_{69}	x_{70}
200694_	1VK2D	19,86	19,75	19,87	19,74	19,83	19,91	19,78	19,80	19,86	19,88
200694_	1VK2D	30,00	29,00	29,00	30,00	30,00	30,00	30,00	29,00	30,00	30,00

Char.No.	Char.Descr.	x_{71}	x_{72}	x_{73}	x_{74}	x_{75}	x_{76}	x_{77}	x_{78}	x_{79}	x_{80}
200694_	1VK2D	19,90	19,82	19,74	19,87	19,84	19,77	19,73	19,82	19,90	19,85
200694_	1VK2D	30,00	30,00	30,00	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 03.02.2022

Ser.No.	756029_d	Characteristic			
Type	1BD-1B060A-1K2D-1VK2D	Char.Descr.	1VK2D	Inspection Val.	19,61
Ord. No.	1BD53T2O-A	Ser.No.	200694_1	LSL	18,24
				USL	20,98
Remark	TQ 30% hard +/-7% * TQ-Cal.: 60.0 Nm; Cur-Cal.: 3.8391 Nm/A; Speed: 700/50 rpm;				

Char.No.	Char.Descr.	x_{81}	x_{82}	x_{83}	x_{84}	x_{85}	x_{86}	x_{87}	x_{88}	x_{89}	x_{90}
200694_	1VK2D	19,85	19,83	19,85	19,85	19,93	19,72	19,79	19,83	19,78	19,80
200694_	1VK2D	30,00	30,00	30,00	30,00	30,00	30,00	30,00	30,00	30,00	30,00

Char.No.	Char.Descr.	x_{91}	x_{92}	x_{93}	x_{94}	x_{95}	x_{96}	x_{97}	x_{98}	x_{99}	x_{100}
200694_	1VK2D	19,77	19,86	19,90	19,75	19,77	19,79	19,74	19,80	19,87	19,76
200694_	1VK2D	30,00	30,00	30,00	30,00	30,00	30,00	29,00	30,00	30,00	29,00

Machine Capability Study
Tool System

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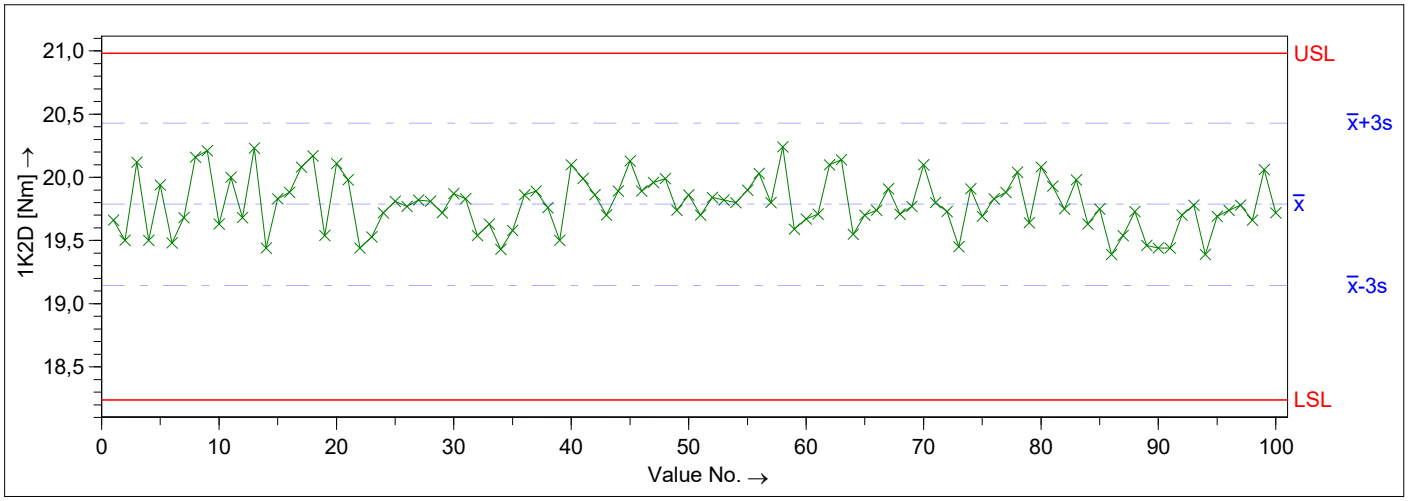
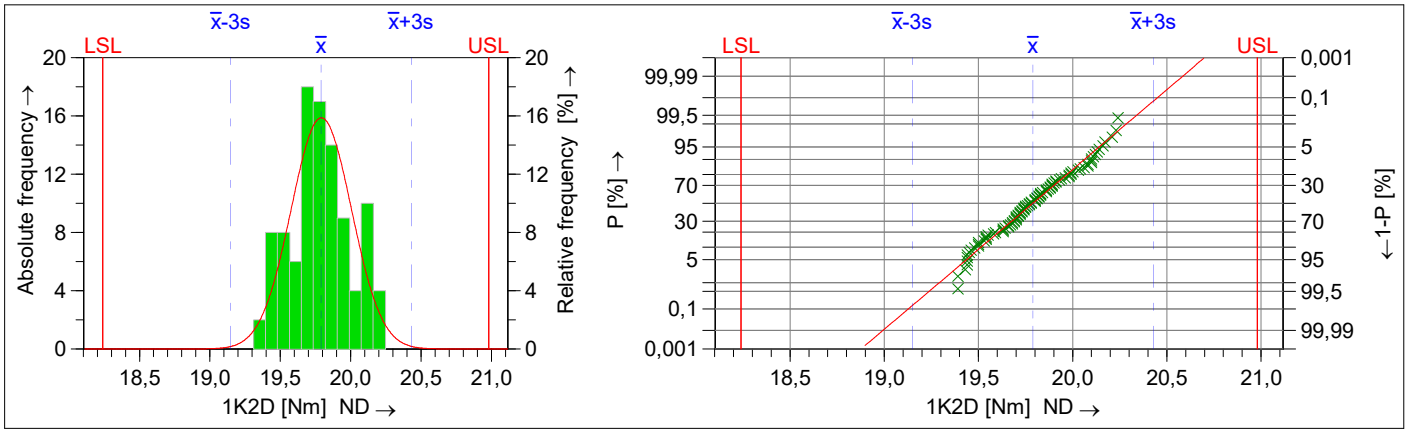
Plant ATG Westhausen		Operator Name Sünder	Date 03.02.2022

Ord. No. 1BD53T2O-A	Part type 1BD-1B060A-1K2D-1VK2D				Contr.item yes
Serial No. 756029_d	Char.Descr. 1K2D	Inspection Val.	19,61	1,37	USL 20,98
	Serial No. 202853	Unit	Nm	-1,37	LSL 18,24
Char.Type variable		Tolerance value	7 %		Decimal Pl. 2
Cust.Name Cleco	Reference System VM1698-4	Test Electronic MPRO400GCD-P			
Contr.No. Homologation	Reference Transducer 50 / 1024729	nges. 100			

Evaluation from 03.02.2022 14:00:29 to 03.02.2022 14:14:18

Rem. TQ 30% hard +/-7% * TQ-Cal.: 60.0 Nm; Cur-Cal.: 3.8391 Nm/A; Speed: 700/50 rpm;





Drawing Values		Collected Values		Statistics	
T_m	19.61			$\bar{x}$	19.7887
LSL	18.24	x_{min}	19.39	$\bar{x}$-3s	19.1478
USL	20.98	x_{max}	20.24	$\bar{x}$+3s	20.4296
T	2.74	R	0.85	6s	1.2819
		$n_{<T>}$	100	$p_{<T>}$	100.00000 %
		$n_{>USL}$	0	$p_{>USL}$	0.00000%
		$n_{<LSL}$	0	$p_{<LSL}$	0.00000%
		n_{eff}	100		
		n_{tot}	100		

Model distribution			Normal Distribution
Calculation method			$M1_{1.4}$ $\hat{\sigma} = s_{tot}$
Potential Capability index	=	C_m	2.14
Critical capability index	=	C_{mk}	1.86

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 03.02.2022

Ser.No.	756029_d	Characteristic			
Type	1BD-1B060A-1K2D-1VK2D	Char.Descr.	1K2D	Inspection Val.	19,61
Ord. No.	1BD53T2O-A	Ser.No.	202853	LSL	18,24
				USL	20,98
Remark	TQ 30% hard +/-7% * TQ-Cal.: 60.0 Nm; Cur-Cal.: 3.8391 Nm/A; Speed: 700/50 rpm;				

Char.No.	Char.Descr.	x_1	x_2	x_3	x_4	x_5	x_6	x_7	x_8	x_9	x_{10}
202853	1K2D	19,66	19,50	20,12	19,50	19,94	19,48	19,68	20,16	20,21	19,63
202853	1K2D	31,00	30,00	31,00	30,00	30,00	30,00	30,00	31,00	30,00	30,00

Char.No.	Char.Descr.	x_{11}	x_{12}	x_{13}	x_{14}	x_{15}	x_{16}	x_{17}	x_{18}	x_{19}	x_{20}
202853	1K2D	20,00	19,68	20,23	19,44	19,83	19,88	20,08	20,17	19,54	20,11
202853	1K2D	31,00	31,00	30,00	30,00	30,00	30,00	30,00	30,00	30,00	30,00

Char.No.	Char.Descr.	x_{21}	x_{22}	x_{23}	x_{24}	x_{25}	x_{26}	x_{27}	x_{28}	x_{29}	x_{30}
202853	1K2D	19,98	19,44	19,53	19,72	19,81	19,77	19,82	19,81	19,72	19,87
202853	1K2D	29,00	30,00	30,00	30,00	29,00	30,00	30,00	30,00	30,00	30,00

Char.No.	Char.Descr.	x_{31}	x_{32}	x_{33}	x_{34}	x_{35}	x_{36}	x_{37}	x_{38}	x_{39}	x_{40}
202853	1K2D	19,83	19,54	19,63	19,43	19,58	19,86	19,89	19,76	19,50	20,10
202853	1K2D	30,00	30,00	30,00	29,00	29,00	30,00	30,00	30,00	29,00	29,00

Char.No.	Char.Descr.	x_{41}	x_{42}	x_{43}	x_{44}	x_{45}	x_{46}	x_{47}	x_{48}	x_{49}	x_{50}
202853	1K2D	19,99	19,86	19,70	19,89	20,13	19,89	19,96	19,99	19,74	19,86
202853	1K2D	30,00	30,00	30,00	30,00	30,00	30,00	30,00	30,00	30,00	30,00

Char.No.	Char.Descr.	x_{51}	x_{52}	x_{53}	x_{54}	x_{55}	x_{56}	x_{57}	x_{58}	x_{59}	x_{60}
202853	1K2D	19,70	19,84	19,82	19,80	19,90	20,03	19,80	20,24	19,59	19,67
202853	1K2D	30,00	30,00	30,00	30,00	30,00	30,00	30,00	30,00	30,00	30,00

Char.No.	Char.Descr.	x_{61}	x_{62}	x_{63}	x_{64}	x_{65}	x_{66}	x_{67}	x_{68}	x_{69}	x_{70}
202853	1K2D	19,71	20,10	20,14	19,55	19,70	19,74	19,91	19,71	19,77	20,10
202853	1K2D	30,00	29,00	29,00	30,00	30,00	30,00	30,00	29,00	30,00	30,00

Char.No.	Char.Descr.	x_{71}	x_{72}	x_{73}	x_{74}	x_{75}	x_{76}	x_{77}	x_{78}	x_{79}	x_{80}
202853	1K2D	19,80	19,73	19,45	19,91	19,69	19,83	19,88	20,04	19,64	20,08
202853	1K2D	30,00	30,00	30,00	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 03.02.2022

Ser.No.	756029_d	Characteristic			
Type	1BD-1B060A-1K2D-1VK2D	Char.Descr.	1K2D	Inspection Val.	19,61
Ord. No.	1BD53T2O-A	Ser.No.	202853	LSL	18,24
				USL	20,98
Remark	TQ 30% hard +/-7% * TQ-Cal.: 60.0 Nm; Cur-Cal.: 3.8391 Nm/A; Speed: 700/50 rpm;				

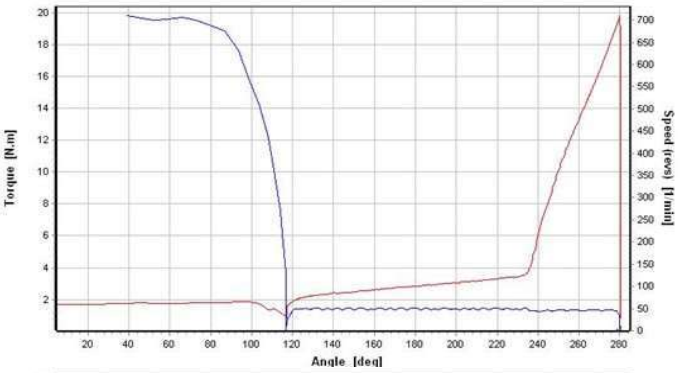
Char.No.	Char.Descr.	x_{81}	x_{82}	x_{83}	x_{84}	x_{85}	x_{86}	x_{87}	x_{88}	x_{89}	x_{90}
202853	1K2D	19,93	19,75	19,98	19,63	19,75	19,39	19,54	19,73	19,46	19,44
202853	1K2D	30,00	30,00	30,00	30,00	30,00	30,00	30,00	30,00	30,00	30,00

Char.No.	Char.Descr.	x_{91}	x_{92}	x_{93}	x_{94}	x_{95}	x_{96}	x_{97}	x_{98}	x_{99}	x_{100}
202853	1K2D	19,44	19,70	19,78	19,39	19,69	19,74	19,78	19,66	20,06	19,72
202853	1K2D	30,00	30,00	30,00	30,00	30,00	30,00	29,00	30,00	30,00	29,00

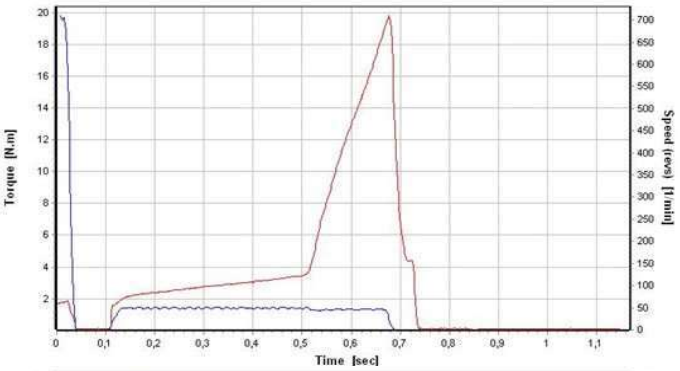
Torque graphs

Model: **1BD-1B060A-1K2D-1VK2D**
Serial no: **756029**

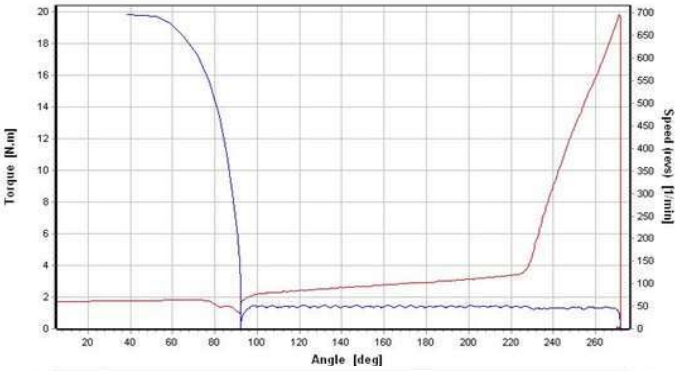
Machine Capability Study 30 %
Angle degree: **30°**
Test torque: **19,6 Nm**



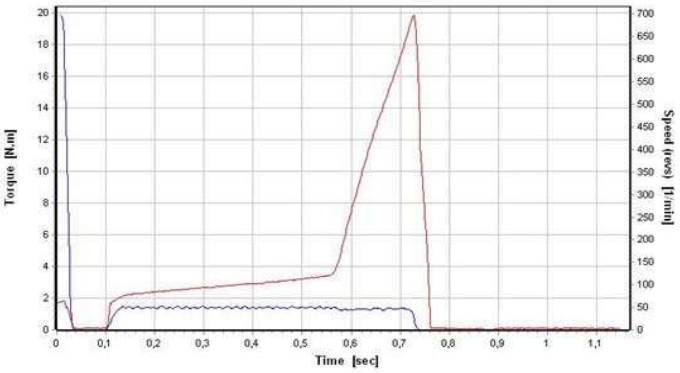
Value no. 1
Graph
Torque / Angle / Speed



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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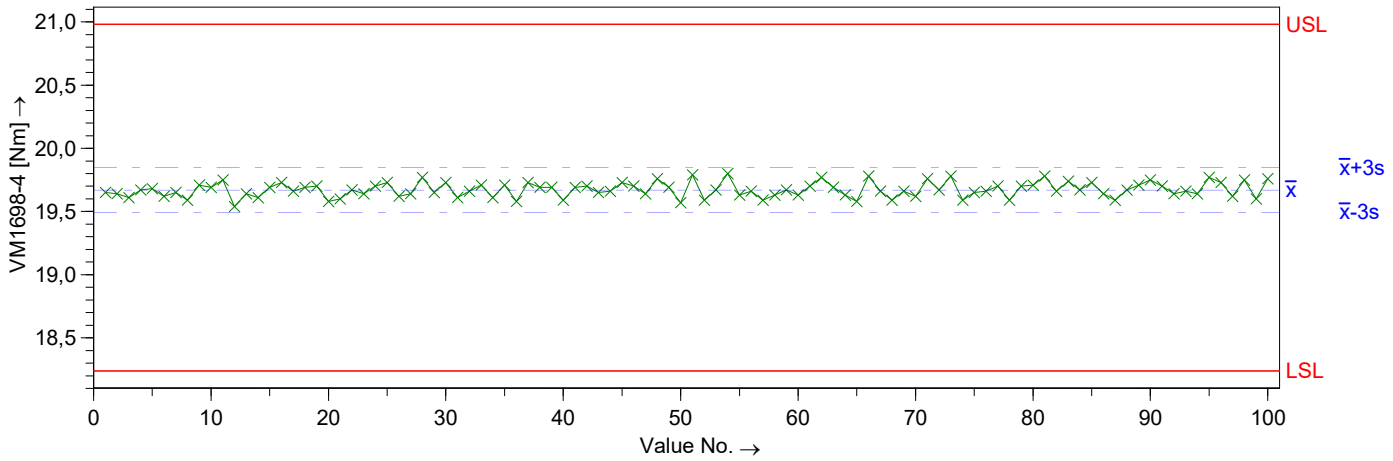
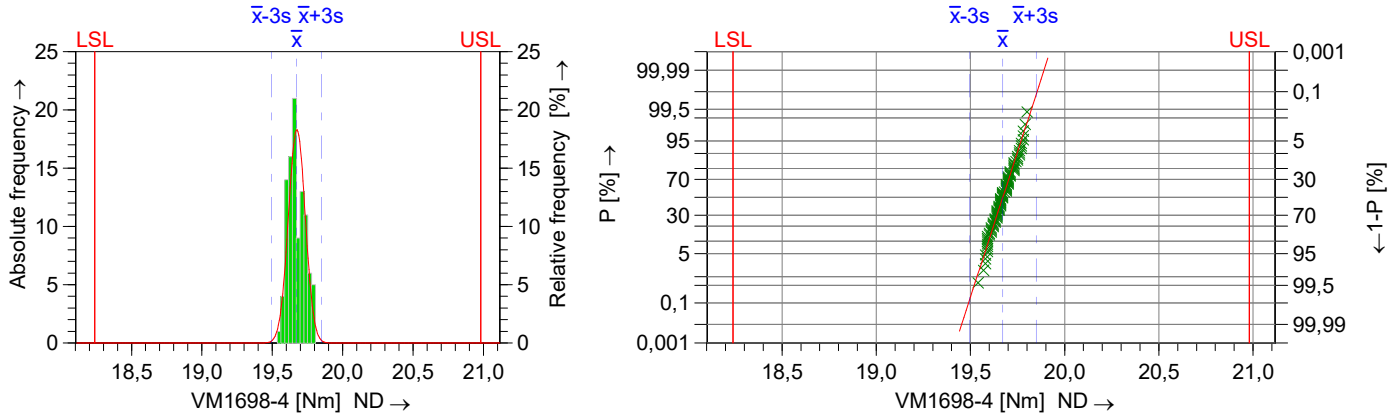
Plant ATG Westhausen		Operator Name Sünder	Date 03.02.2022

Ord. No. 1BD53T2O-A	Part type 1BD-1B060A-1K2D-1VK2D		Contr.item yes
Serial No. 756029_c	Char.Descr. VM1698-4	Inspection Val. 19,61 1,37	USL 20,98
	Serial No. 1024210	Unit Nm -1,37	LSL 18,24
Char.Type variable		Tolerance value 7 %	Decimal Pl. 2
Cust.Name Cleco	Reference System VM1698-4	Test Electronic MPRO400GCD-P	
Contr.No. Homologation	Reference Transducer 50 / 1024729	nges. 100	

Evaluation from 03.02.2022 14:17:16 to 03.02.2022 14:34:24

Rem. TQ 30% soft +/-7% * TQ-Cal.: 60.0 Nm; Cur-Cal.: 3.8391 Nm/A; Speed: 700/50 rpm;





Drawing Values		Collected Values		Statistics	
T_m	19.61			$\bar{x}$	19.6718
LSL	18.24	x_{min}	19.54	$\bar{x}$-3s	19.4954
USL	20.98	x_{max}	19.80	$\bar{x}$+3s	19.8482
T	2.74	R	0.26	6s	0.3529
		$n_{<T>}$	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	7.76
Critical capability index	=	C_{mk}	7.41

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

APEX VDI/VDE 2647 V0.1

Apex Tool Group GmbH \\htwe0006\AppData\QW\QWE\MessWert\2022\756029_cM.DFD

Machine Capability Study
Control System

Plant	ATG Westhausen		Operator Name	Sünder	Date 03.02.2022

Ser.No.	756029_c	Characteristic			
Type	1BD-1B060A-1K2D-1VK2D	Char.Descr.	VM1698-4	Inspection Val.	19,61
Ord. No.	1BD53T2O-A	Ser.No.	1024210	LSL	18,24
				USL	20,98
Remark	TQ 30% soft +/-7% * TQ-Cal.: 60.0 Nm; Cur-Cal.: 3.8391 Nm/A; Speed: 700/50 rpm;				

Char.No.	Char.Descr.	x_1	x_2	x_3	x_4	x_5	x_6	x_7	x_8	x_9	x_{10}
1024210	VM1698-4	19,65	19,64	19,61	19,67	19,68	19,62	19,65	19,59	19,71	19,69
1024210	VM1698-4	373,75	370,75	372,25	365,25	363,75	364,50	366,00	362,00	368,50	366,50

Char.No.	Char.Descr.	x_{11}	x_{12}	x_{13}	x_{14}	x_{15}	x_{16}	x_{17}	x_{18}	x_{19}	x_{20}
1024210	VM1698-4	19,75	19,54	19,64	19,61	19,69	19,73	19,66	19,69	19,70	19,58
1024210	VM1698-4	365,25	355,00	362,25	368,75	360,00	369,00	374,00	367,25	358,25	357,50

Char.No.	Char.Descr.	x_{21}	x_{22}	x_{23}	x_{24}	x_{25}	x_{26}	x_{27}	x_{28}	x_{29}	x_{30}
1024210	VM1698-4	19,60	19,67	19,64	19,70	19,73	19,62	19,64	19,77	19,65	19,73
1024210	VM1698-4	354,25	363,50	357,75	359,75	354,75	357,50	358,00	354,00	356,25	354,25

Char.No.	Char.Descr.	x_{31}	x_{32}	x_{33}	x_{34}	x_{35}	x_{36}	x_{37}	x_{38}	x_{39}	x_{40}
1024210	VM1698-4	19,61	19,66	19,71	19,61	19,71	19,58	19,73	19,69	19,69	19,59
1024210	VM1698-4	356,50	355,25	354,25	356,50	360,25	360,50	358,50	359,50	356,75	359,75

Char.No.	Char.Descr.	x_{41}	x_{42}	x_{43}	x_{44}	x_{45}	x_{46}	x_{47}	x_{48}	x_{49}	x_{50}
1024210	VM1698-4	19,69	19,70	19,65	19,66	19,73	19,70	19,64	19,76	19,69	19,57
1024210	VM1698-4	356,75	354,50	368,25	357,25	354,50	360,00	357,25	366,00	356,25	355,00

Char.No.	Char.Descr.	x_{51}	x_{52}	x_{53}	x_{54}	x_{55}	x_{56}	x_{57}	x_{58}	x_{59}	x_{60}
1024210	VM1698-4	19,79	19,59	19,67	19,80	19,63	19,66	19,59	19,63	19,67	19,63
1024210	VM1698-4	358,75	352,50	356,50	359,50	352,75	353,75	349,50	356,50	360,00	360,75

Char.No.	Char.Descr.	x_{61}	x_{62}	x_{63}	x_{64}	x_{65}	x_{66}	x_{67}	x_{68}	x_{69}	x_{70}
1024210	VM1698-4	19,70	19,77	19,69	19,63	19,58	19,78	19,66	19,59	19,66	19,62
1024210	VM1698-4	359,25	367,25	360,75	364,75	362,50	358,75	358,00	355,75	356,25	356,00

Char.No.	Char.Descr.	x_{71}	x_{72}	x_{73}	x_{74}	x_{75}	x_{76}	x_{77}	x_{78}	x_{79}	x_{80}
1024210	VM1698-4	19,76	19,67	19,78	19,59	19,65	19,66	19,70	19,59	19,70	19,71
1024210	VM1698-4	360,00	357,50	358,25	352,75	360,75	356,00	360,75	356,50	362,75	359,25

Machine Capability Study
Control System

Plant	ATG Westhausen		Operator Name	Sünder	Date 03.02.2022

Ser.No.	756029_c	Characteristic			
Type	1BD-1B060A-1K2D-1VK2D	Char.Descr.	VM1698-4	Inspection Val.	19,61
Ord. No.	1BD53T2O-A	Ser.No.	1024210	LSL	18,24
				USL	20,98
Remark	TQ 30% soft +/-7% * TQ-Cal.: 60.0 Nm; Cur-Cal.: 3.8391 Nm/A; Speed: 700/50 rpm;				

Char.No.	Char.Descr.	x_{81}	x_{82}	x_{83}	x_{84}	x_{85}	x_{86}	x_{87}	x_{88}	x_{89}	x_{90}
1024210	VM1698-4	19,78	19,66	19,74	19,67	19,73	19,64	19,59	19,67	19,71	19,75
1024210	VM1698-4	365,50	355,25	359,00	356,75	355,25	353,00	354,75	356,25	351,75	359,00

Char.No.	Char.Descr.	x_{91}	x_{92}	x_{93}	x_{94}	x_{95}	x_{96}	x_{97}	x_{98}	x_{99}	x_{100}
1024210	VM1698-4	19,70	19,64	19,66	19,64	19,77	19,73	19,62	19,75	19,60	19,76
1024210	VM1698-4	353,75	359,00	355,25	354,00	360,75	353,25	354,50	357,75	353,25	363,75

Machine Capability Study
Tool System

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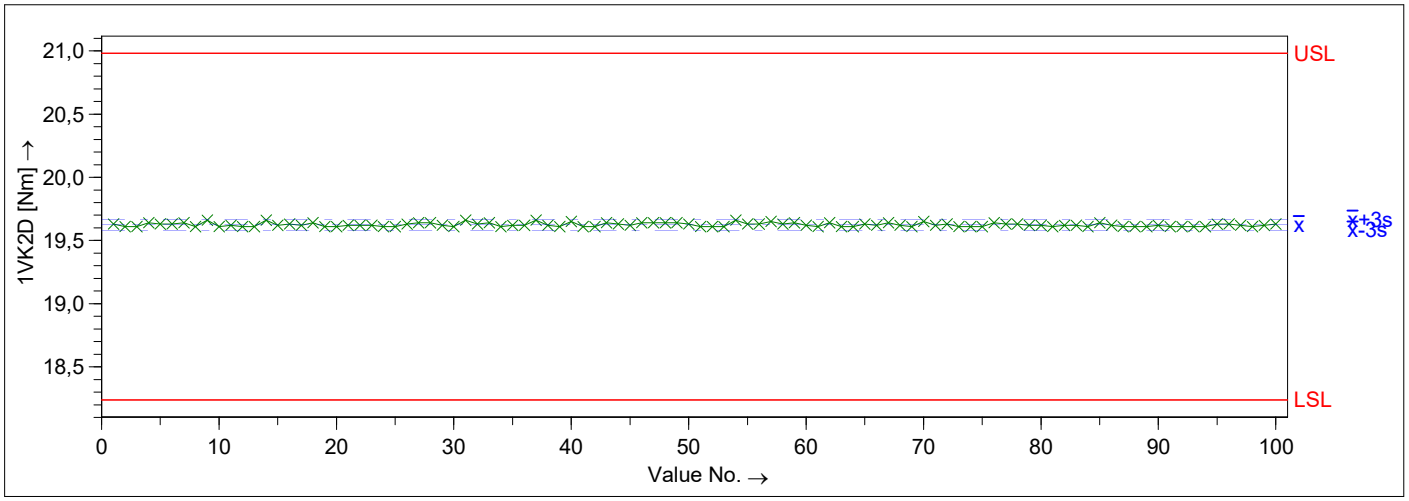
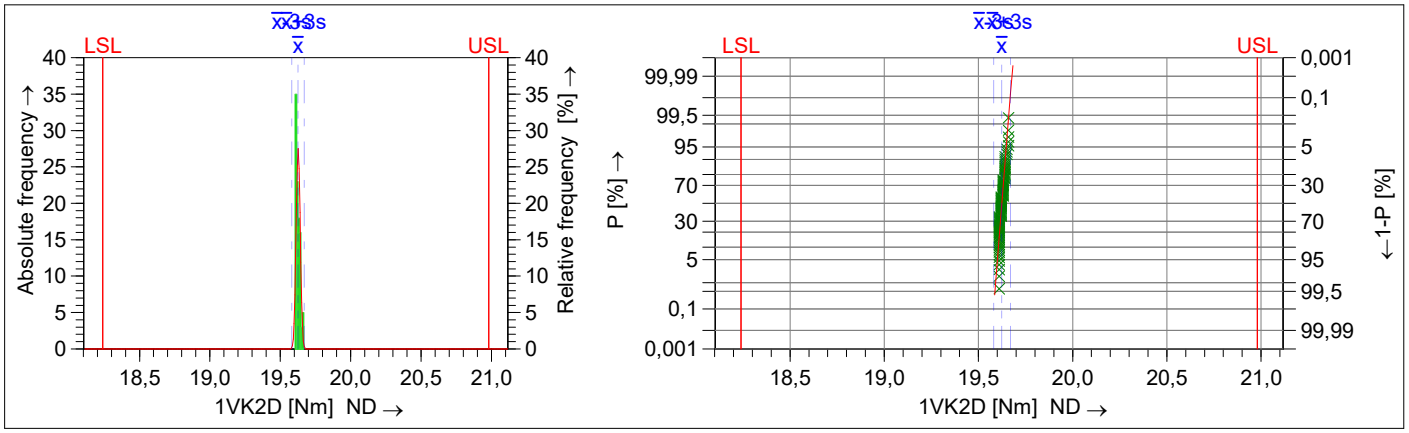
Plant	ATG Westhausen	Operator Name	Sünder
Date	03.02.2022		

Ord. No.	1BD53T2O-A	Part type	1BD-1B060A-1K2D-1VK2D	Contr.item	yes
Serial No.	756029_c	Char.Descr.	1VK2D	Inspection Val. 19,61 1,37	USL 20,98
		Serial No.	200694_1	Unit Nm -1,37	LSL 18,24
Char.Type	variable			Tolerance value 7 %	Decimal Pl. 2
Cust.Name	Cleco	Reference System	VM1698-4	Test Electronic	MPRO400GCD-P
Contr.No.	Homologation	Reference Transducer	50 / 1024729	nges.	100

Evaluation from 03.02.2022 14:17:16 to 03.02.2022 14:34:25

Rem. TQ 30% soft +/-7% * TQ-Cal.: 60.0 Nm; Cur-Cal.: 3.8391 Nm/A; Speed: 700/50 rpm;





Drawing Values		Collected Values		Statistics	
T_m	19.61			$\bar{x}$	19.6244
LSL	18.24	x_{min}	19.61	$\bar{x}$-3s	19.5813
USL	20.98	x_{max}	19.66	$\bar{x}$+3s	19.6675
T	2.74	R	0.05	6s	0.0863
		$n_{<T>}$	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	31.76
Critical capability index	=	C_{mk}	31.43

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 03.02.2022

Ser.No.	756029_c	Characteristic			
Type	1BD-1B060A-1K2D-1VK2D	Char.Descr.	1VK2D	Inspection Val.	19,61
Ord. No.	1BD53T2O-A	Ser.No.	200694_1	LSL	18,24
				USL	20,98
Remark	TQ 30% soft +/-7% * TQ-Cal.: 60.0 Nm; Cur-Cal.: 3.8391 Nm/A; Speed: 700/50 rpm;				

Char.No.	Char.Descr.	x_1	x_2	x_3	x_4	x_5	x_6	x_7	x_8	x_9	x_{10}
200694_	1VK2D	19,63	19,61	19,61	19,64	19,63	19,63	19,64	19,61	19,66	19,61
200694_	1VK2D	368,00	368,00	370,00	361,00	360,00	363,00	363,00	359,00	364,00	363,00

Char.No.	Char.Descr.	x_{11}	x_{12}	x_{13}	x_{14}	x_{15}	x_{16}	x_{17}	x_{18}	x_{19}	x_{20}
200694_	1VK2D	19,62	19,61	19,61	19,66	19,62	19,63	19,62	19,64	19,61	19,61
200694_	1VK2D	358,00	353,00	358,00	365,00	355,00	366,00	372,00	363,00	354,00	356,00

Char.No.	Char.Descr.	x_{21}	x_{22}	x_{23}	x_{24}	x_{25}	x_{26}	x_{27}	x_{28}	x_{29}	x_{30}
200694_	1VK2D	19,62	19,62	19,62	19,61	19,61	19,63	19,64	19,64	19,62	19,61
200694_	1VK2D	352,00	361,00	355,00	356,00	349,00	354,00	357,00	348,00	351,00	349,00

Char.No.	Char.Descr.	x_{31}	x_{32}	x_{33}	x_{34}	x_{35}	x_{36}	x_{37}	x_{38}	x_{39}	x_{40}
200694_	1VK2D	19,66	19,63	19,64	19,61	19,62	19,62	19,66	19,62	19,61	19,65
200694_	1VK2D	355,00	353,00	351,00	354,00	358,00	359,00	354,00	354,00	353,00	359,00

Char.No.	Char.Descr.	x_{41}	x_{42}	x_{43}	x_{44}	x_{45}	x_{46}	x_{47}	x_{48}	x_{49}	x_{50}
200694_	1VK2D	19,61	19,61	19,64	19,63	19,62	19,64	19,64	19,64	19,64	19,63
200694_	1VK2D	350,00	352,00	366,00	355,00	351,00	357,00	354,00	362,00	349,00	353,00

Char.No.	Char.Descr.	x_{51}	x_{52}	x_{53}	x_{54}	x_{55}	x_{56}	x_{57}	x_{58}	x_{59}	x_{60}
200694_	1VK2D	19,61	19,61	19,61	19,66	19,63	19,63	19,65	19,63	19,64	19,62
200694_	1VK2D	352,00	352,00	353,00	354,00	351,00	351,00	346,00	353,00	359,00	357,00

Char.No.	Char.Descr.	x_{61}	x_{62}	x_{63}	x_{64}	x_{65}	x_{66}	x_{67}	x_{68}	x_{69}	x_{70}
200694_	1VK2D	19,61	19,64	19,61	19,61	19,63	19,62	19,64	19,62	19,61	19,65
200694_	1VK2D	353,00	365,00	356,00	362,00	361,00	355,00	355,00	352,00	353,00	353,00

Char.No.	Char.Descr.	x_{71}	x_{72}	x_{73}	x_{74}	x_{75}	x_{76}	x_{77}	x_{78}	x_{79}	x_{80}
200694_	1VK2D	19,62	19,63	19,61	19,61	19,61	19,64	19,63	19,63	19,62	19,62
200694_	1VK2D	355,00	355,00	353,00	351,00	358,00	353,00	357,00	356,00	357,00	355,00

Machine Capability Study
Tool System

Plant	ATG Westhausen		Operator Name	Sünder	Date 03.02.2022

Ser.No.	756029_c	Characteristic			
Type	1BD-1B060A-1K2D-1VK2D	Char.Descr.	1VK2D	Inspection Val.	19,61
Ord. No.	1BD53T2O-A	Ser.No.	200694_1	LSL	18,24
				USL	20,98
Remark	TQ 30% soft +/-7% * TQ-Cal.: 60.0 Nm; Cur-Cal.: 3.8391 Nm/A; Speed: 700/50 rpm;				

Char.No.	Char.Descr.	x_{81}	x_{82}	x_{83}	x_{84}	x_{85}	x_{86}	x_{87}	x_{88}	x_{89}	x_{90}
200694_	1VK2D	19,61	19,62	19,62	19,61	19,64	19,62	19,61	19,61	19,61	19,62
200694_	1VK2D	359,00	352,00	355,00	354,00	351,00	349,00	353,00	353,00	348,00	355,00

Char.No.	Char.Descr.	x_{91}	x_{92}	x_{93}	x_{94}	x_{95}	x_{96}	x_{97}	x_{98}	x_{99}	x_{100}
200694_	1VK2D	19,61	19,61	19,61	19,61	19,63	19,63	19,62	19,61	19,62	19,63
200694_	1VK2D	350,00	357,00	352,00	353,00	356,00	350,00	353,00	354,00	351,00	360,00

Machine Capability Study
Tool System

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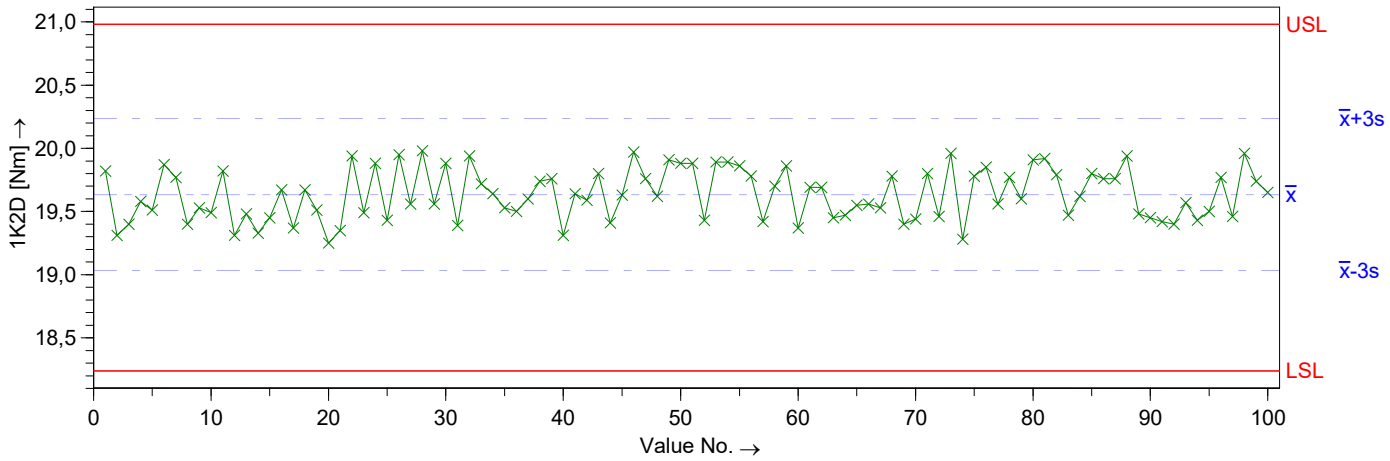
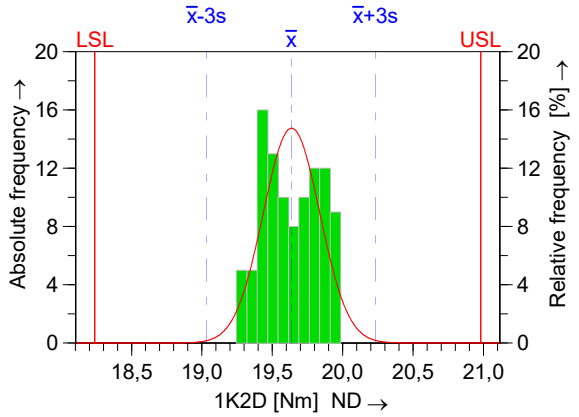
Plant	ATG Westhausen	Operator Name	Sünder
Date	03.02.2022		

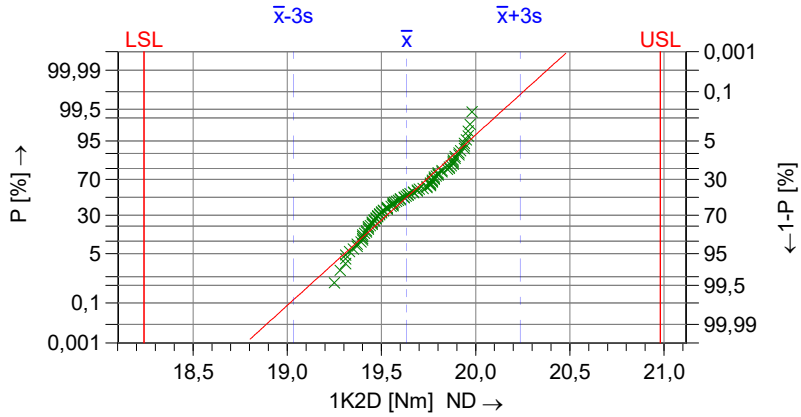
Ord. No.	1BD53T2O-A	Part type	1BD-1B060A-1K2D-1VK2D	Contr.item	yes
Serial No.	756029_c	Char.Descr.	1K2D	Inspection Val. 19,61 1,37	USL 20,98
		Serial No.	202853	Unit Nm -1,37	LSL 18,24
Char.Type	variable			Tolerance value 7 %	Decimal Pl. 2
Cust.Name	Cleco	Reference System	VM1698-4	Test Electronic	MPRO400GCD-P
Contr.No.	Homologation	Reference Transducer	50 / 1024729	nges.	100

Evaluation from 03.02.2022 14:17:17 to 03.02.2022 14:34:25

Rem. TQ 30% soft +/-7% * TQ-Cal.: 60.0 Nm; Cur-Cal.: 3.8391 Nm/A; Speed: 700/50 rpm;







Drawing Values		Collected Values		Statistics	
T_m	19.61			x̄	19.6340
LSL	18.24	x_{min}	19.25	x̄-3s	19.0334
USL	20.98	x_{max}	19.98	x̄+3s	20.2346
T	2.74	R	0.73	6s	1.2012
		$n_{<T>}$	100	$p_{<T>}$	100.00000 %
		$n_{>USL}$	0	$p_{>USL}$	0.00000%
		$n_{<LSL}$	0	$p_{<LSL}$	0.00000%
		n_{eff}	100		
		n_{tot}	100		

Model distribution			Normal Distribution
Calculation method			$M1_{1.4}$ $\hat{\sigma} = s_{tot}$
Potential Capability index	=	C_m	2.28
Critical capability index	=	C_{mk}	2.24

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 03.02.2022

Ser.No.	756029_c	Characteristic			
Type	1BD-1B060A-1K2D-1VK2D	Char.Descr.	1K2D	Inspection Val.	19,61
Ord. No.	1BD53T2O-A	Ser.No.	202853	LSL	18,24
				USL	20,98
Remark	TQ 30% soft +/-7% * TQ-Cal.: 60.0 Nm; Cur-Cal.: 3.8391 Nm/A; Speed: 700/50 rpm;				

Char.No.	Char.Descr.	x_1	x_2	x_3	x_4	x_5	x_6	x_7	x_8	x_9	x_{10}
202853	1K2D	19,82	19,31	19,40	19,58	19,51	19,87	19,77	19,40	19,53	19,49
202853	1K2D	368,00	368,00	370,00	361,00	360,00	363,00	363,00	359,00	364,00	363,00

Char.No.	Char.Descr.	x_{11}	x_{12}	x_{13}	x_{14}	x_{15}	x_{16}	x_{17}	x_{18}	x_{19}	x_{20}
202853	1K2D	19,82	19,31	19,48	19,33	19,45	19,67	19,37	19,67	19,51	19,25
202853	1K2D	358,00	353,00	358,00	365,00	355,00	366,00	372,00	363,00	354,00	356,00

Char.No.	Char.Descr.	x_{21}	x_{22}	x_{23}	x_{24}	x_{25}	x_{26}	x_{27}	x_{28}	x_{29}	x_{30}
202853	1K2D	19,35	19,94	19,49	19,88	19,43	19,95	19,56	19,98	19,56	19,88
202853	1K2D	352,00	361,00	355,00	356,00	349,00	354,00	357,00	348,00	351,00	349,00

Char.No.	Char.Descr.	x_{31}	x_{32}	x_{33}	x_{34}	x_{35}	x_{36}	x_{37}	x_{38}	x_{39}	x_{40}
202853	1K2D	19,39	19,94	19,72	19,64	19,53	19,50	19,60	19,74	19,76	19,31
202853	1K2D	355,00	353,00	351,00	354,00	358,00	359,00	354,00	354,00	353,00	359,00

Char.No.	Char.Descr.	x_{41}	x_{42}	x_{43}	x_{44}	x_{45}	x_{46}	x_{47}	x_{48}	x_{49}	x_{50}
202853	1K2D	19,64	19,59	19,80	19,41	19,63	19,97	19,76	19,62	19,91	19,88
202853	1K2D	350,00	352,00	366,00	355,00	351,00	357,00	354,00	362,00	349,00	353,00

Char.No.	Char.Descr.	x_{51}	x_{52}	x_{53}	x_{54}	x_{55}	x_{56}	x_{57}	x_{58}	x_{59}	x_{60}
202853	1K2D	19,88	19,43	19,89	19,89	19,86	19,78	19,42	19,70	19,86	19,37
202853	1K2D	352,00	352,00	353,00	354,00	351,00	351,00	346,00	353,00	359,00	357,00

Char.No.	Char.Descr.	x_{61}	x_{62}	x_{63}	x_{64}	x_{65}	x_{66}	x_{67}	x_{68}	x_{69}	x_{70}
202853	1K2D	19,69	19,69	19,45	19,47	19,55	19,56	19,53	19,78	19,40	19,44
202853	1K2D	353,00	365,00	356,00	362,00	361,00	355,00	355,00	352,00	353,00	353,00

Char.No.	Char.Descr.	x_{71}	x_{72}	x_{73}	x_{74}	x_{75}	x_{76}	x_{77}	x_{78}	x_{79}	x_{80}
202853	1K2D	19,80	19,46	19,96	19,28	19,78	19,85	19,56	19,77	19,60	19,91
202853	1K2D	355,00	355,00	353,00	351,00	358,00	353,00	357,00	356,00	357,00	355,00

Machine Capability Study
Tool System

Plant	ATG Westhausen		Operator Name	Sünder	Date 03.02.2022

Ser.No.	756029_c	Characteristic			
Type	1BD-1B060A-1K2D-1VK2D	Char.Descr.	1K2D	Inspection Val.	19,61
Ord. No.	1BD53T2O-A	Ser.No.	202853	LSL	18,24
				USL	20,98
Remark	TQ 30% soft +/-7% * TQ-Cal.: 60.0 Nm; Cur-Cal.: 3.8391 Nm/A; Speed: 700/50 rpm;				

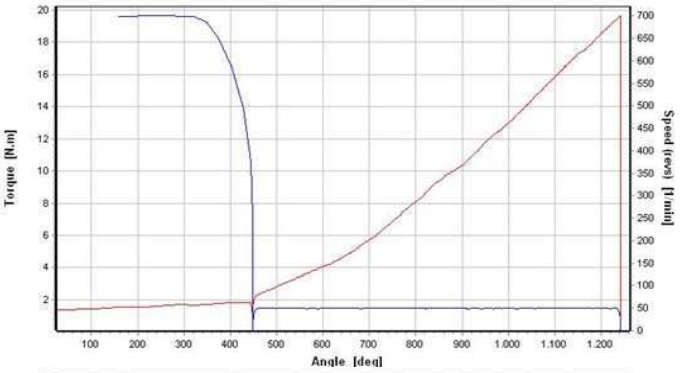
Char.No.	Char.Descr.	x_{81}	x_{82}	x_{83}	x_{84}	x_{85}	x_{86}	x_{87}	x_{88}	x_{89}	x_{90}
202853	1K2D	19,92	19,79	19,47	19,62	19,80	19,76	19,76	19,94	19,48	19,45
202853	1K2D	359,00	352,00	355,00	354,00	351,00	349,00	353,00	353,00	348,00	355,00

Char.No.	Char.Descr.	x_{91}	x_{92}	x_{93}	x_{94}	x_{95}	x_{96}	x_{97}	x_{98}	x_{99}	x_{100}
202853	1K2D	19,42	19,40	19,57	19,43	19,50	19,77	19,46	19,96	19,74	19,65
202853	1K2D	350,00	357,00	352,00	353,00	356,00	350,00	353,00	354,00	351,00	360,00

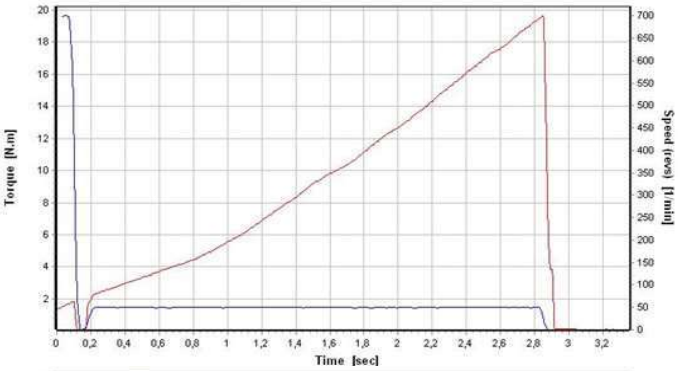
Torque graphs

Model: **1BD-1B060A-1K2D-1VK2D**
Serial no: **756029**

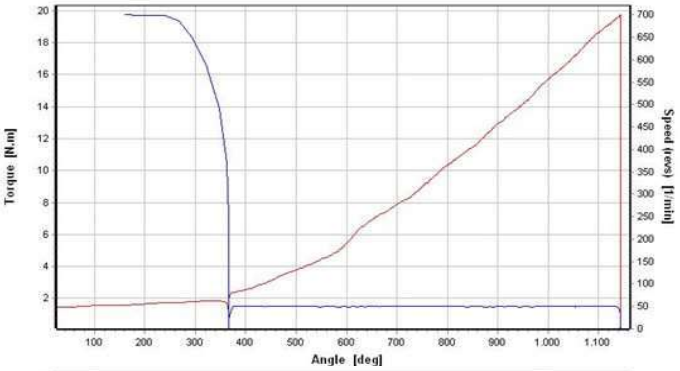
Machine Capability Study 30 %
Angle degree: **360°**
Test torque: **19,6 Nm**



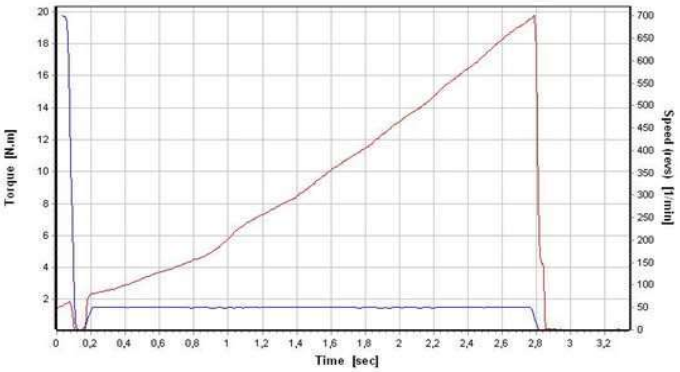
Value no. 1
Graph
Torque / Angle / Speed



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	7,1 %
Single-stage tightening system	☐	Speed 100 %	700 rpm

Manufacturer: Apex Tool Group Serial no: **756029**

Test torque: Tq min. + 0.8 (Tq max. - Tq min.) 43,46 Nm

Hard joint (H)	263,29 Nm / Revolution	Angle degree	30°
Soft joint (L)	21,73 Nm / Revolution	Angle degree	360°

		H	L
a)	Tolerance down / up	40,42 46,50 Nm	40,42 - 46,50 Nm
	Tolerance down / up	7	7 %
	Average torque	43,88	43,47 Nm
	Standard deviation	0,12	0,11 Nm
	Torque scatter (99,73%)	0,70	0,66 Nm
	C_m	8,72	9,28
	C_{mk}	7,51	9,25

b)	Min. C_m hard/soft (lowest value)	8,72
	Min. C_{mk} hard/soft (lowest value)	7,51

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

Note:

Machine Capability Study
Control System

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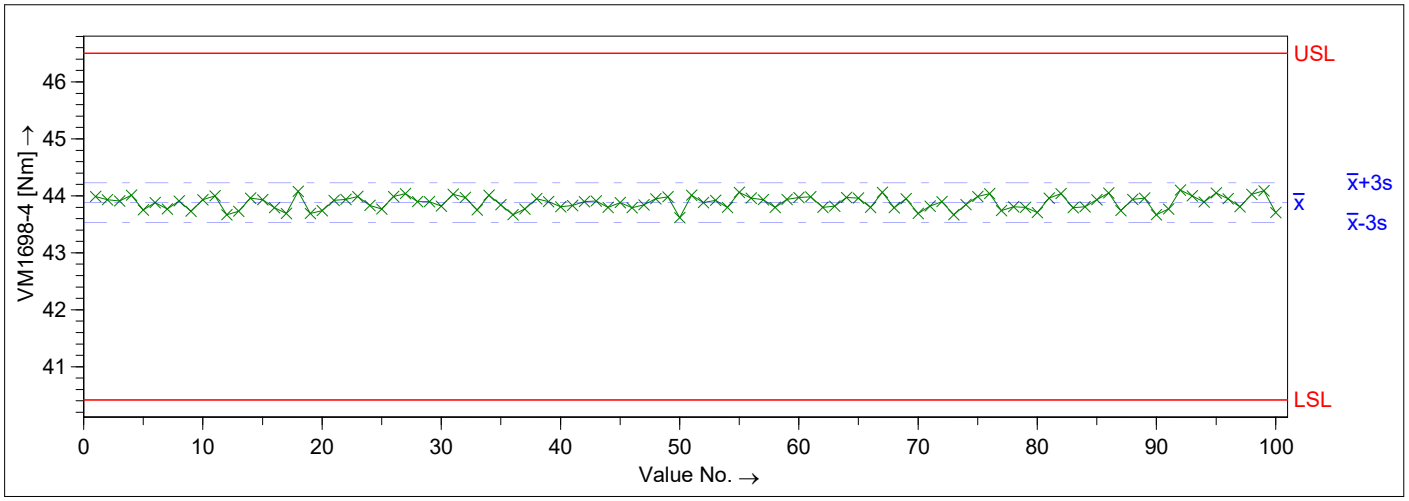
Plant ATG Westhausen		Operator Name Sünder	Date 03.02.2022

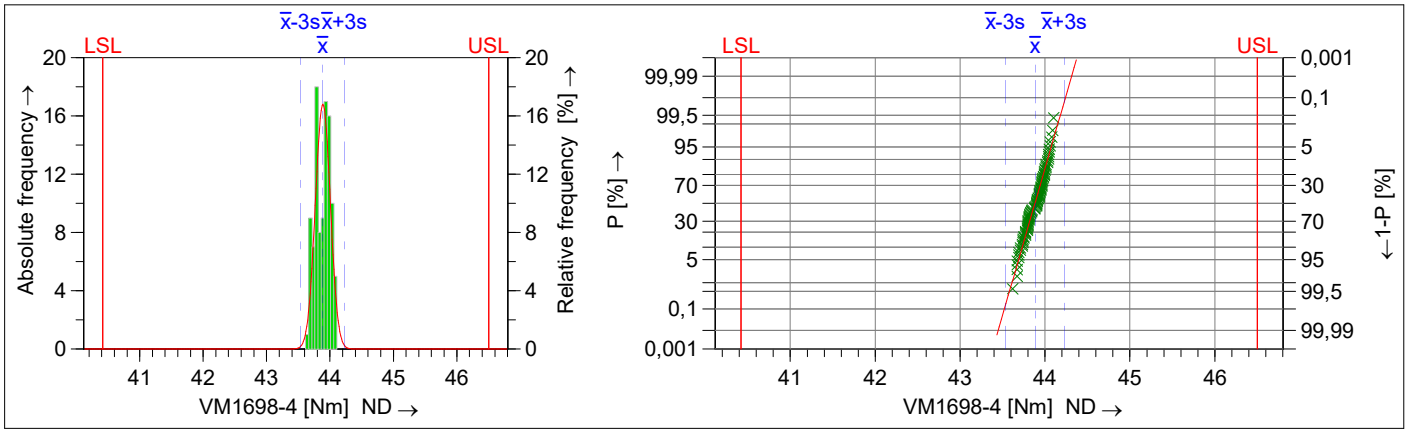
Ord. No. 1BD53T2O-A	Part type 1BD-1B060A-1K2D-1VK2D				Contr.item yes
Serial No. 756029_h	Char.Descr. VM1698-4	Inspection Val.	43,46	3,04	USL 46,50
	Serial No. 1024210	Unit	Nm	-3,04	LSL 40,42
Char.Type variable		Tolerance value	7 %		Decimal Pl. 2

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

Evaluation from 03.02.2022 13:40:59 to 03.02.2022 13:57:57

Rem. TQ 80% hard +/-7% * TQ-Cal.: 60.0 Nm; Cur-Cal.: 3.8391 Nm/A; Speed: 700/50 rpm;





Drawing Values		Collected Values		Statistics	
T_m	43.46			$\bar{x}$	43.8810
LSL	40.42	x_{min}	43.62	$\bar{x}$-3s	43.5322
USL	46.50	x_{max}	44.10	$\bar{x}$+3s	44.2298
T	6.08	R	0.48	6s	0.6976
		$n_{<T>}$	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	8.72
Critical capability index	=	C_{mk}	7.51

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 03.02.2022

Ser.No.	756029_h	Characteristic			
Type	1BD-1B060A-1K2D-1VK2D	Char.Descr.	VM1698-4	Inspection Val.	43,46
Ord. No.	1BD53T2O-A	Ser.No.	1024210	LSL	40,42
				USL	46,50
Remark	TQ 80% hard +/-7% * TQ-Cal.: 60.0 Nm; Cur-Cal.: 3.8391 Nm/A; Speed: 700/50 rpm;				

Char.No.	Char.Descr.	x_1	x_2	x_3	x_4	x_5	x_6	x_7	x_8	x_9	x_{10}
1024210	VM1698-4	43,99	43,93	43,91	44,01	43,75	43,88	43,77	43,91	43,73	43,93
1024210	VM1698-4	30,50	31,00	31,00	31,00	30,50	30,75	30,50	30,75	30,75	30,75

Char.No.	Char.Descr.	x_{11}	x_{12}	x_{13}	x_{14}	x_{15}	x_{16}	x_{17}	x_{18}	x_{19}	x_{20}
1024210	VM1698-4	44,00	43,67	43,73	43,96	43,93	43,79	43,69	44,08	43,69	43,74
1024210	VM1698-4	30,50	30,75	30,25	30,75	30,50	30,75	30,25	31,00	30,75	30,25

Char.No.	Char.Descr.	x_{21}	x_{22}	x_{23}	x_{24}	x_{25}	x_{26}	x_{27}	x_{28}	x_{29}	x_{30}
1024210	VM1698-4	43,92	43,94	43,99	43,83	43,77	43,99	44,04	43,90	43,90	43,82
1024210	VM1698-4	30,50	31,00	30,50	30,50	30,25	31,00	30,75	30,75	30,50	30,25

Char.No.	Char.Descr.	x_{31}	x_{32}	x_{33}	x_{34}	x_{35}	x_{36}	x_{37}	x_{38}	x_{39}	x_{40}
1024210	VM1698-4	44,03	43,97	43,75	44,01	43,84	43,67	43,77	43,95	43,90	43,81
1024210	VM1698-4	30,50	30,50	30,50	30,50	30,75	27,75	30,50	31,00	30,75	30,75

Char.No.	Char.Descr.	x_{41}	x_{42}	x_{43}	x_{44}	x_{45}	x_{46}	x_{47}	x_{48}	x_{49}	x_{50}
1024210	VM1698-4	43,83	43,90	43,91	43,80	43,88	43,79	43,84	43,95	43,98	43,62
1024210	VM1698-4	30,75	30,75	30,75	28,00	30,25	29,50	29,75	30,75	30,25	30,25

Char.No.	Char.Descr.	x_{51}	x_{52}	x_{53}	x_{54}	x_{55}	x_{56}	x_{57}	x_{58}	x_{59}	x_{60}
1024210	VM1698-4	44,01	43,88	43,92	43,80	44,06	43,96	43,93	43,80	43,94	43,97
1024210	VM1698-4	31,00	30,75	31,00	30,25	30,75	30,50	30,75	30,50	31,00	30,75

Char.No.	Char.Descr.	x_{61}	x_{62}	x_{63}	x_{64}	x_{65}	x_{66}	x_{67}	x_{68}	x_{69}	x_{70}
1024210	VM1698-4	43,98	43,80	43,82	43,97	43,96	43,80	44,06	43,79	43,95	43,69
1024210	VM1698-4	30,75	31,00	30,50	30,50	30,25	30,00	30,00	30,00	30,25	29,75

Char.No.	Char.Descr.	x_{71}	x_{72}	x_{73}	x_{74}	x_{75}	x_{76}	x_{77}	x_{78}	x_{79}	x_{80}
1024210	VM1698-4	43,82	43,90	43,67	43,85	43,99	44,04	43,74	43,81	43,80	43,71
1024210	VM1698-4	30,00	30,25	30,00	30,50	30,00	30,00	29,75	29,75	29,50	29,75

Machine Capability Study
Control System

Plant	ATG Westhausen		Operator Name	Sünder	Date 03.02.2022

Ser.No.	756029_h	Characteristic			
Type	1BD-1B060A-1K2D-1VK2D	Char.Descr.	VM1698-4	Inspection Val.	43,46
Ord. No.	1BD53T2O-A	Ser.No.	1024210	LSL	40,42
				USL	46,50
Remark	TQ 80% hard +/-7% * TQ-Cal.: 60.0 Nm; Cur-Cal.: 3.8391 Nm/A; Speed: 700/50 rpm;				

Char.No.	Char.Descr.	x_{81}	x_{82}	x_{83}	x_{84}	x_{85}	x_{86}	x_{87}	x_{88}	x_{89}	x_{90}
1024210	VM1698-4	43,96	44,04	43,79	43,81	43,93	44,05	43,74	43,94	43,96	43,67
1024210	VM1698-4	30,00	30,50	30,00	29,75	30,25	30,00	29,75	30,00	30,00	29,75

Char.No.	Char.Descr.	x_{91}	x_{92}	x_{93}	x_{94}	x_{95}	x_{96}	x_{97}	x_{98}	x_{99}	x_{100}
1024210	VM1698-4	43,77	44,10	44,00	43,89	44,05	43,95	43,81	44,03	44,09	43,71
1024210	VM1698-4	30,00	30,00	30,25	30,00	29,75	29,75	29,75	30,00	30,00	30,00

Machine Capability Study
Tool System

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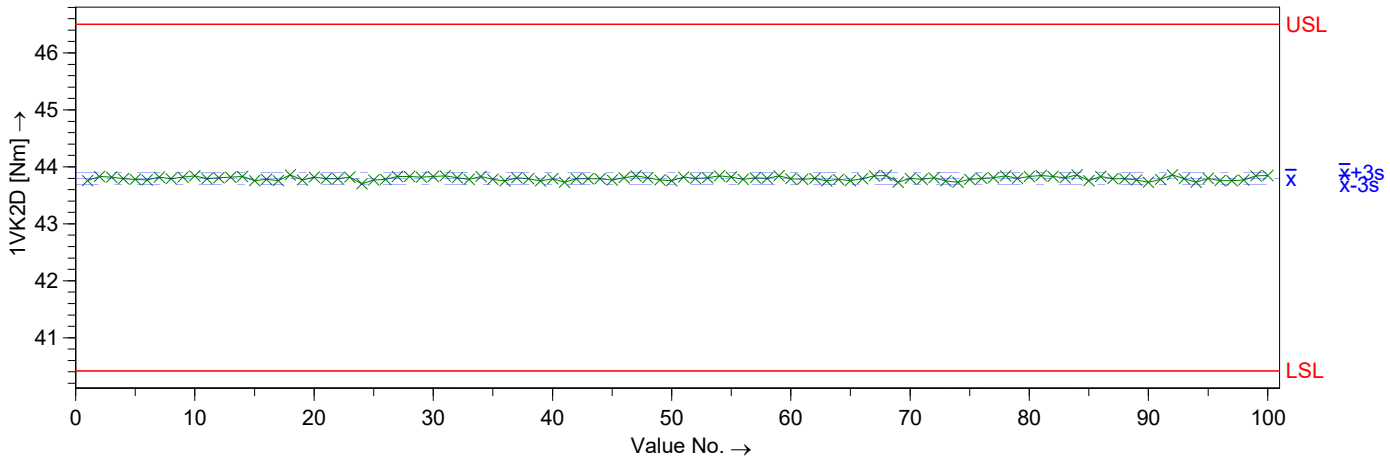
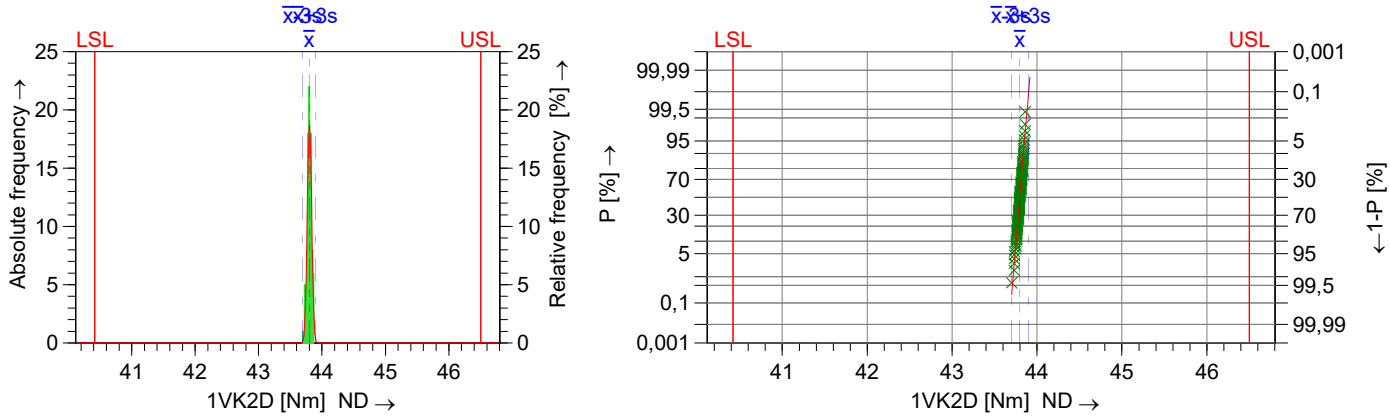
Plant	ATG Westhausen	Operator Name	Sünder
Date	03.02.2022		

Ord. No.	1BD53T2O-A	Part type	1BD-1B060A-1K2D-1VK2D	Contr.item	yes
Serial No.	756029_h	Char.Descr.	1VK2D	Inspection Val. 43,46 3,04	USL 46,50
		Serial No.	200694_1	Unit Nm -3,04	LSL 40,42
Char.Type	variable			Tolerance value 7 %	Decimal Pl. 2
Cust.Name	Cleco	Reference System	VM1698-4	Test Electronic	MPRO400GCD-P
Contr.No.	Homologation	Reference Transducer	50 / 1024729	nges.	100

Evaluation from 03.02.2022 13:40:59 to 03.02.2022 13:57:57

Rem. TQ 80% hard +/-7% * TQ-Cal.: 60.0 Nm; Cur-Cal.: 3.8391 Nm/A; Speed: 700/50 rpm;





Drawing Values		Collected Values		Statistics	
T_m	43.46			$\bar{x}$	43.7965
LSL	40.42	x_{min}	43.70	$\bar{x}$-3s	43.6956
USL	46.50	x_{max}	43.86	$\bar{x}$+3s	43.8974
T	6.08	R	0.16	6s	0.2019
		$n_{<T>}$	100	$p_{<T>}$	100.00000 %
		$n_{>USL}$	0	$p_{>USL}$	0.00000%
		$n_{<LSL}$	0	$p_{<LSL}$	0.00000%
		n_{eff}	100		
		n_{tot}	100		

Model distribution			Normal Distribution
Calculation method			$M1_{1.4}$ $\hat{\sigma} = s_{tot}$
Potential Capability index	=	C_m	30.12
Critical capability index	=	C_{mk}	26.78

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

APEX VDI/VDE 2647 V0.1

Apex Tool Group GmbH \\htwe0006\AppData\QW\QWE\MessWert\2022\756029_h1.DFD

Machine Capability Study
Tool System

Plant	ATG Westhausen		Operator Name	Sünder	Date 03.02.2022

Ser.No.	756029_h	Characteristic			
Type	1BD-1B060A-1K2D-1VK2D	Char.Descr.	1VK2D	Inspection Val.	43,46
Ord. No.	1BD53T2O-A	Ser.No.	200694_1	LSL	40,42
				USL	46,50
Remark	TQ 80% hard +/-7% * TQ-Cal.: 60.0 Nm; Cur-Cal.: 3.8391 Nm/A; Speed: 700/50 rpm;				

Char.No.	Char.Descr.	x_1	x_2	x_3	x_4	x_5	x_6	x_7	x_8	x_9	x_{10}
200694_	1VK2D	43,76	43,83	43,82	43,79	43,78	43,77	43,82	43,79	43,82	43,84
200694_	1VK2D	30,00	31,00	31,00	31,00	31,00	31,00	31,00	31,00	31,00	30,00

Char.No.	Char.Descr.	x_{11}	x_{12}	x_{13}	x_{14}	x_{15}	x_{16}	x_{17}	x_{18}	x_{19}	x_{20}
200694_	1VK2D	43,79	43,81	43,82	43,83	43,76	43,78	43,76	43,86	43,77	43,82
200694_	1VK2D	31,00	30,00	31,00	31,00	30,00	31,00	30,00	31,00	30,00	31,00

Char.No.	Char.Descr.	x_{21}	x_{22}	x_{23}	x_{24}	x_{25}	x_{26}	x_{27}	x_{28}	x_{29}	x_{30}
200694_	1VK2D	43,79	43,79	43,82	43,70	43,77	43,78	43,83	43,83	43,82	43,83
200694_	1VK2D	30,00	31,00	31,00	30,00	31,00	31,00	30,00	30,00	30,00	30,00

Char.No.	Char.Descr.	x_{31}	x_{32}	x_{33}	x_{34}	x_{35}	x_{36}	x_{37}	x_{38}	x_{39}	x_{40}
200694_	1VK2D	43,84	43,81	43,78	43,83	43,78	43,75	43,81	43,79	43,75	43,79
200694_	1VK2D	31,00	30,00	30,00	31,00	30,00	30,00	30,00	31,00	31,00	31,00

Char.No.	Char.Descr.	x_{41}	x_{42}	x_{43}	x_{44}	x_{45}	x_{46}	x_{47}	x_{48}	x_{49}	x_{50}
200694_	1VK2D	43,73	43,79	43,79	43,79	43,77	43,81	43,84	43,81	43,77	43,76
200694_	1VK2D	30,00	31,00	31,00	30,00	30,00	29,00	29,00	31,00	31,00	30,00

Char.No.	Char.Descr.	x_{51}	x_{52}	x_{53}	x_{54}	x_{55}	x_{56}	x_{57}	x_{58}	x_{59}	x_{60}
200694_	1VK2D	43,82	43,80	43,81	43,84	43,82	43,78	43,81	43,80	43,84	43,79
200694_	1VK2D	31,00	30,00	31,00	30,00	31,00	31,00	30,00	30,00	31,00	31,00

Char.No.	Char.Descr.	x_{61}	x_{62}	x_{63}	x_{64}	x_{65}	x_{66}	x_{67}	x_{68}	x_{69}	x_{70}
200694_	1VK2D	43,78	43,80	43,75	43,78	43,76	43,79	43,84	43,85	43,73	43,80
200694_	1VK2D	31,00	31,00	30,00	31,00	30,00	30,00	30,00	30,00	30,00	30,00

Char.No.	Char.Descr.	x_{71}	x_{72}	x_{73}	x_{74}	x_{75}	x_{76}	x_{77}	x_{78}	x_{79}	x_{80}
200694_	1VK2D	43,78	43,81	43,75	43,73	43,78	43,80	43,81	43,84	43,80	43,83
200694_	1VK2D	30,00	30,00	30,00	31,00	30,00	30,00	29,00	29,00	30,00	30,00

Machine Capability Study
Tool System

Plant	ATG Westhausen		Operator Name	Sünder	Date 03.02.2022

Ser.No.	756029_h	Characteristic			
Type	1BD-1B060A-1K2D-1VK2D	Char.Descr.	1VK2D	Inspection Val.	43,46
Ord. No.	1BD53T2O-A	Ser.No.	200694_1	LSL	40,42
				USL	46,50
Remark	TQ 80% hard +/-7% * TQ-Cal.: 60.0 Nm; Cur-Cal.: 3.8391 Nm/A; Speed: 700/50 rpm;				

Char.No.	Char.Descr.	x_{81}	x_{82}	x_{83}	x_{84}	x_{85}	x_{86}	x_{87}	x_{88}	x_{89}	x_{90}
200694_	1VK2D	43,85	43,83	43,81	43,86	43,76	43,83	43,79	43,79	43,77	43,73
200694_	1VK2D	30,00	30,00	29,00	30,00	30,00	30,00	30,00	30,00	30,00	29,00

Char.No.	Char.Descr.	x_{91}	x_{92}	x_{93}	x_{94}	x_{95}	x_{96}	x_{97}	x_{98}	x_{99}	x_{100}
200694_	1VK2D	43,78	43,86	43,79	43,73	43,80	43,76	43,76	43,77	43,84	43,85
200694_	1VK2D	30,00	30,00	30,00	30,00	30,00	30,00	30,00	30,00	30,00	30,00

Machine Capability Study
Tool System

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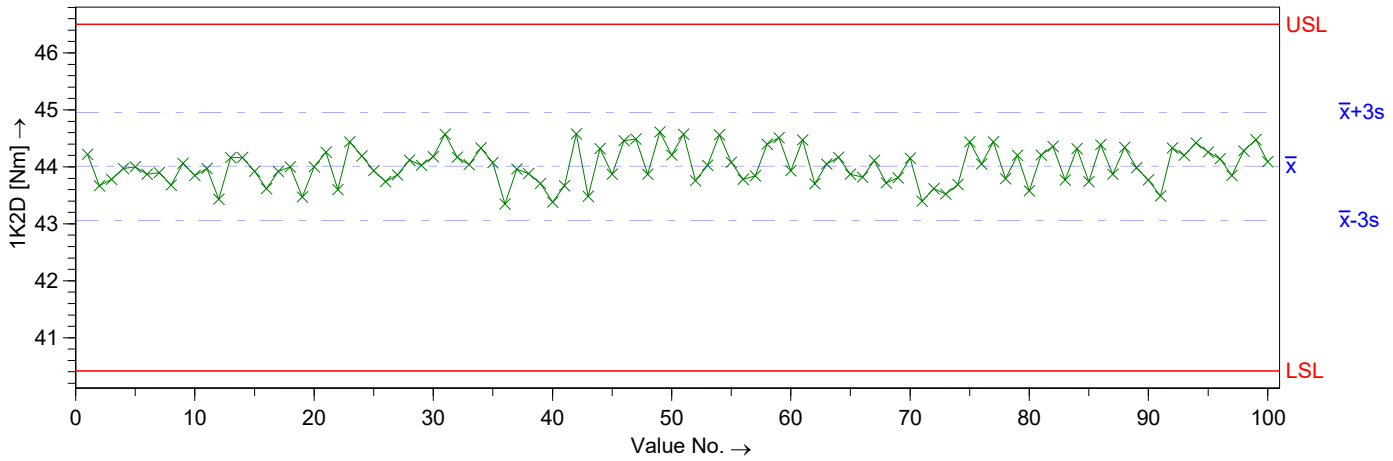
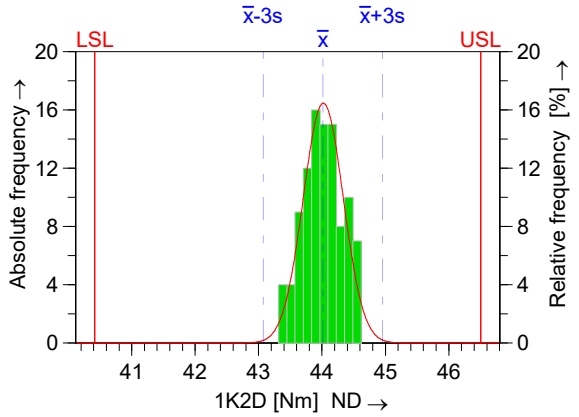
Plant	ATG Westhausen	Operator Name	Sünder
Date	03.02.2022		

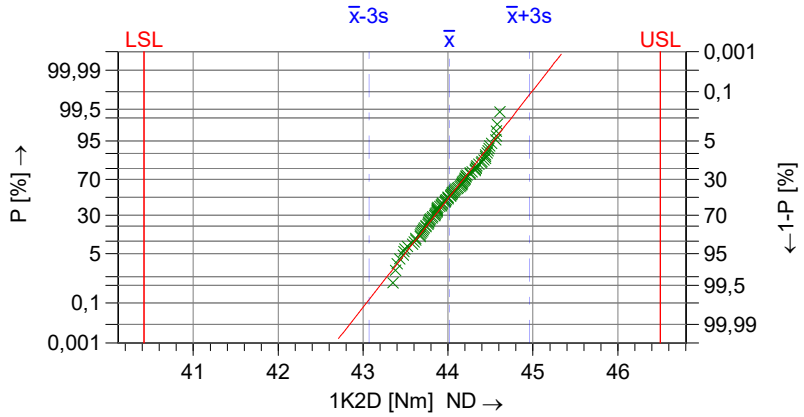
Ord. No.	1BD53T2O-A	Part type	1BD-1B060A-1K2D-1VK2D	Contr.item	yes
Serial No.	756029_h	Char.Descr.	1K2D	Inspection Val. 43,46 3,04	USL 46,50
		Serial No.	202853	Unit Nm -3,04	LSL 40,42
Char.Type	variable			Tolerance value 7 %	Decimal Pl. 2
Cust.Name	Cleco	Reference System	VM1698-4	Test Electronic	MPRO400GCD-P
Contr.No.	Homologation	Reference Transducer	50 / 1024729	nges.	100

Evaluation from 03.02.2022 13:40:59 to 03.02.2022 13:57:57

Rem. TQ 80% hard +/-7% * TQ-Cal.: 60.0 Nm; Cur-Cal.: 3.8391 Nm/A; Speed: 700/50 rpm;







Drawing Values		Collected Values		Statistics	
T_m	43.46			$\bar{x}$	44.0137
LSL	40.42	x_{min}	43.35	$\bar{x}$-3s	43.0688
USL	46.50	x_{max}	44.61	$\bar{x}$+3s	44.9586
T	6.08	R	1.26	6s	1.8899
		$n_{<T>}$	100	$p_{<T>}$	100.00000 %
		$n_{>USL}$	0	$p_{>USL}$	0.00000%
		$n_{<LSL}$	0	$p_{<LSL}$	0.00000%
		n_{eff}	100		
		n_{tot}	100		

Model distribution			Normal Distribution
Calculation method			$M1_{1.4}$ $\hat{\sigma} = s_{tot}$
Potential Capability index	=	C_m	3.22
Critical capability index	=	C_{mk}	2.63

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 03.02.2022

Ser.No.	756029_h	Characteristic			
Type	1BD-1B060A-1K2D-1VK2D	Char.Descr.	1K2D	Inspection Val.	43,46
Ord. No.	1BD53T2O-A	Ser.No.	202853	LSL	40,42
				USL	46,50
Remark	TQ 80% hard +/-7% * TQ-Cal.: 60.0 Nm; Cur-Cal.: 3.8391 Nm/A; Speed: 700/50 rpm;				

Char.No.	Char.Descr.	x_1	x_2	x_3	x_4	x_5	x_6	x_7	x_8	x_9	x_{10}
202853	1K2D	44,22	43,67	43,78	43,97	44,00	43,87	43,90	43,68	44,06	43,85
202853	1K2D	30,00	31,00	31,00	31,00	31,00	31,00	31,00	31,00	31,00	30,00

Char.No.	Char.Descr.	x_{11}	x_{12}	x_{13}	x_{14}	x_{15}	x_{16}	x_{17}	x_{18}	x_{19}	x_{20}
202853	1K2D	43,97	43,43	44,16	44,16	43,92	43,62	43,92	44,00	43,47	44,00
202853	1K2D	31,00	30,00	31,00	31,00	30,00	31,00	30,00	31,00	30,00	31,00

Char.No.	Char.Descr.	x_{21}	x_{22}	x_{23}	x_{24}	x_{25}	x_{26}	x_{27}	x_{28}	x_{29}	x_{30}
202853	1K2D	44,26	43,60	44,44	44,19	43,93	43,74	43,86	44,12	44,03	44,18
202853	1K2D	30,00	31,00	31,00	30,00	31,00	31,00	30,00	30,00	30,00	30,00

Char.No.	Char.Descr.	x_{31}	x_{32}	x_{33}	x_{34}	x_{35}	x_{36}	x_{37}	x_{38}	x_{39}	x_{40}
202853	1K2D	44,57	44,17	44,04	44,33	44,07	43,35	43,96	43,88	43,71	43,38
202853	1K2D	31,00	30,00	30,00	31,00	30,00	30,00	30,00	31,00	31,00	31,00

Char.No.	Char.Descr.	x_{41}	x_{42}	x_{43}	x_{44}	x_{45}	x_{46}	x_{47}	x_{48}	x_{49}	x_{50}
202853	1K2D	43,67	44,58	43,48	44,32	43,87	44,46	44,49	43,87	44,61	44,21
202853	1K2D	30,00	31,00	31,00	30,00	30,00	29,00	29,00	31,00	31,00	30,00

Char.No.	Char.Descr.	x_{51}	x_{52}	x_{53}	x_{54}	x_{55}	x_{56}	x_{57}	x_{58}	x_{59}	x_{60}
202853	1K2D	44,57	43,76	44,03	44,56	44,08	43,78	43,84	44,40	44,51	43,93
202853	1K2D	31,00	30,00	31,00	30,00	31,00	31,00	30,00	30,00	31,00	31,00

Char.No.	Char.Descr.	x_{61}	x_{62}	x_{63}	x_{64}	x_{65}	x_{66}	x_{67}	x_{68}	x_{69}	x_{70}
202853	1K2D	44,47	43,70	44,05	44,17	43,87	43,82	44,11	43,72	43,81	44,15
202853	1K2D	31,00	31,00	30,00	31,00	30,00	30,00	30,00	30,00	30,00	30,00

Char.No.	Char.Descr.	x_{71}	x_{72}	x_{73}	x_{74}	x_{75}	x_{76}	x_{77}	x_{78}	x_{79}	x_{80}
202853	1K2D	43,40	43,62	43,52	43,69	44,44	44,05	44,44	43,79	44,20	43,58
202853	1K2D	30,00	30,00	30,00	31,00	30,00	30,00	29,00	29,00	30,00	30,00

Machine Capability Study
Tool System

Plant	ATG Westhausen		Operator Name	Sünder	Date 03.02.2022

Ser.No.	756029_h	Characteristic			
Type	1BD-1B060A-1K2D-1VK2D	Char.Descr.	1K2D	Inspection Val.	43,46
Ord. No.	1BD53T2O-A	Ser.No.	202853	LSL	40,42
				USL	46,50
Remark	TQ 80% hard +/-7% * TQ-Cal.: 60.0 Nm; Cur-Cal.: 3.8391 Nm/A; Speed: 700/50 rpm;				

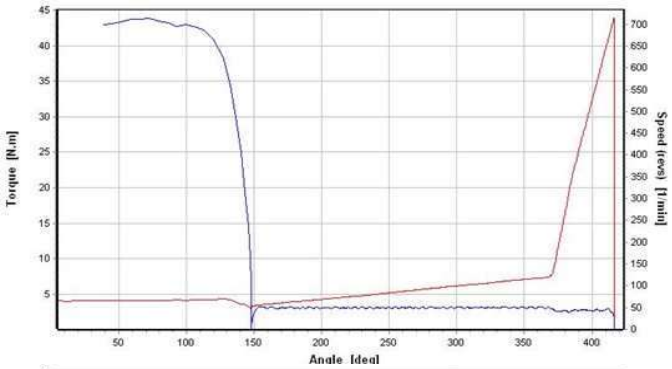
Char.No.	Char.Descr.	x_{81}	x_{82}	x_{83}	x_{84}	x_{85}	x_{86}	x_{87}	x_{88}	x_{89}	x_{90}
202853	1K2D	44,21	44,36	43,77	44,32	43,74	44,39	43,87	44,34	43,98	43,77
202853	1K2D	30,00	30,00	29,00	30,00	30,00	30,00	30,00	30,00	30,00	29,00

Char.No.	Char.Descr.	x_{91}	x_{92}	x_{93}	x_{94}	x_{95}	x_{96}	x_{97}	x_{98}	x_{99}	x_{100}
202853	1K2D	43,49	44,33	44,20	44,42	44,26	44,14	43,85	44,28	44,48	44,09
202853	1K2D	30,00	30,00	30,00	30,00	30,00	30,00	30,00	30,00	30,00	30,00

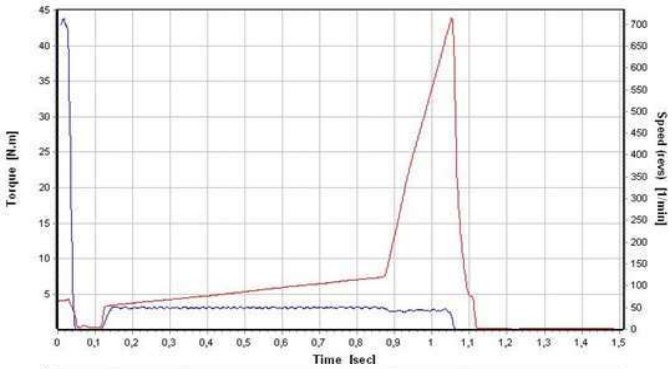
Torque graphs

Model: **1BD-1B060A-1K2D-1VK2D**
Serial no: **756029**

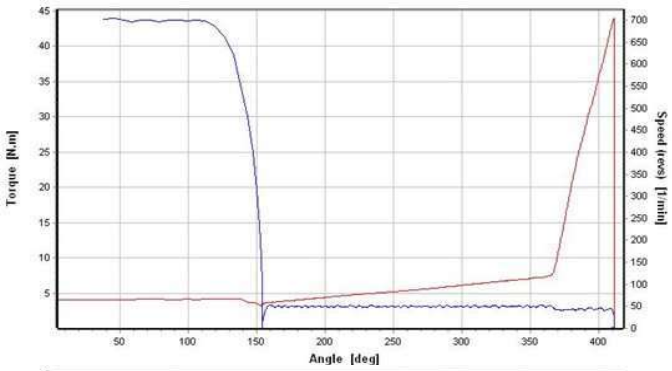
Machine Capability Study 80 %
Angle degree: **30°**
Test torque: **43,5 Nm**



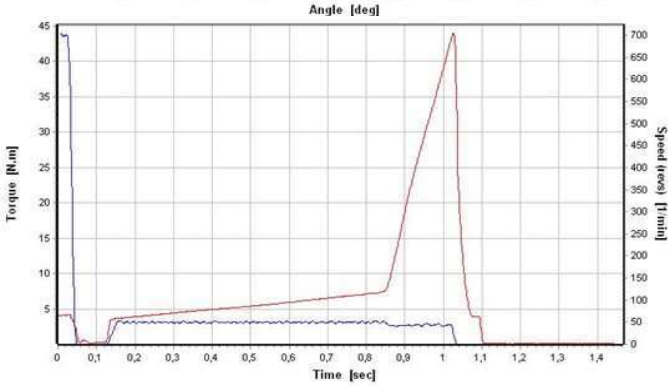
Value no. 1
Graph
Torque / Angle / Speed



Value no. 1
Graph
Torque / Time / Speed



Value no. 100
Graph
Torque / Angle / Speed



Value no. 100
Graph
Torque / Time / Speed

Machine Capability Study
Control System

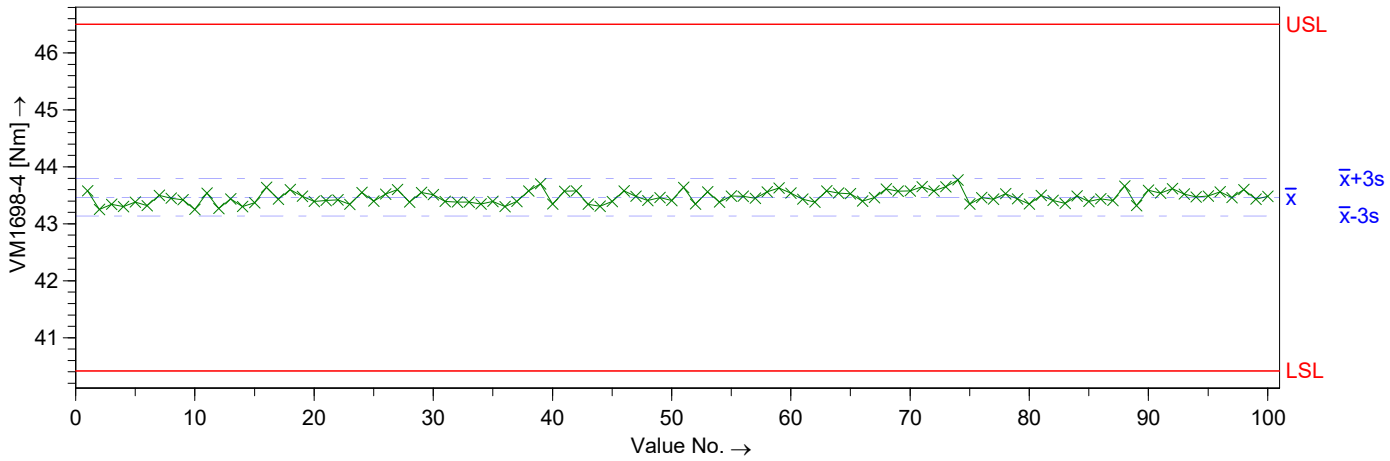
Plant ATG Westhausen		Operator Name Sünder	Date 04.02.2022

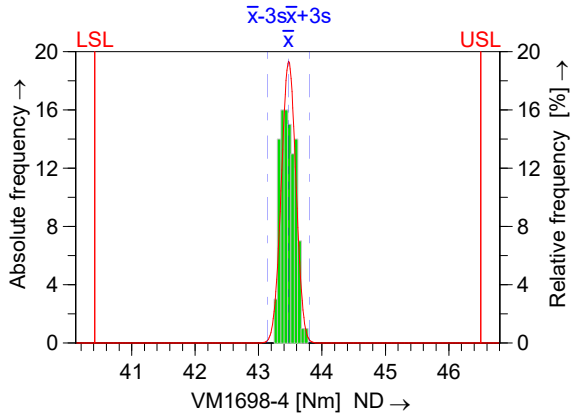
Ord. No. 1BD53T2O-A	Part type 1BD-1B060A-1K2D-1VK2D				Contr.item yes
Serial No. 756029_g	Char.Descr. VM1698-4	Inspection Val.	43,46	3,04	USL 46,50
	Serial No. 1024210	Unit	Nm	-3,04	LSL 40,42
Char.Type variable		Tolerance value	7 %		Decimal Pl. 2

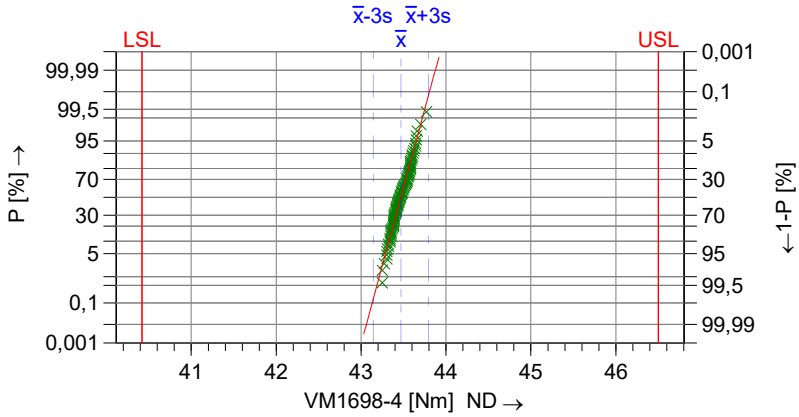
Cust.Name Cleco	Reference System VM1698-4	Test Electronic MPRO400GCD-P
Contr.No. Homologation	Reference Transducer 50 / 1024729	nges. 100

Evaluation from 04.02.2022 07:46:52 to 04.02.2022 08:13:41

Rem. TQ 80% soft +/-7% * TQ-Cal.: 60.0 Nm; Cur-Cal.: 3.8391 Nm/A; Speed: 700/50 rpm;







Drawing Values		Collected Values		Statistics	
T_m	43.46			$\bar{x}$	43.4678
LSL	40.42	x_{min}	43.25	$\bar{x}$-3s	43.1401
USL	46.50	x_{max}	43.77	$\bar{x}$+3s	43.7955
T	6.08	R	0.52	6s	0.6555
		$n_{<T>}$	100	$p_{<T>}$	100.00000 %
		$n_{>USL}$	0	$p_{>USL}$	0.00000%
		$n_{<LSL}$	0	$p_{<LSL}$	0.00000%
		n_{eff}	100		
		n_{tot}	100		

Model distribution			Normal Distribution
Calculation method			M1 1.4 $\hat{\sigma} = s_{tot}$
Potential Capability index	=	C_m	9.28
Critical capability index	=	C_{mk}	9.25

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 04.02.2022

Ser.No.	756029_g	Characteristic			
Type	1BD-1B060A-1K2D-1VK2D	Char.Descr.	VM1698-4	Inspection Val.	43,46
Ord. No.	1BD53T2O-A	Ser.No.	1024210	LSL	40,42
				USL	46,50
Remark	TQ 80% soft +/-7% * TQ-Cal.: 60.0 Nm; Cur-Cal.: 3.8391 Nm/A; Speed: 700/50 rpm;				

Char.No.	Char.Descr.	x_1	x_2	x_3	x_4	x_5	x_6	x_7	x_8	x_9	x_{10}
1024210	VM1698-4	43,58	43,25	43,34	43,30	43,38	43,32	43,50	43,45	43,42	43,25
1024210	VM1698-4	358,75	357,50	359,50	356,50	362,75	358,75	363,25	363,25	369,25	362,75

Char.No.	Char.Descr.	x_{11}	x_{12}	x_{13}	x_{14}	x_{15}	x_{16}	x_{17}	x_{18}	x_{19}	x_{20}
1024210	VM1698-4	43,54	43,27	43,44	43,30	43,37	43,64	43,43	43,60	43,48	43,39
1024210	VM1698-4	356,50	360,25	365,50	363,25	363,00	370,50	365,50	368,00	366,00	355,00

Char.No.	Char.Descr.	x_{21}	x_{22}	x_{23}	x_{24}	x_{25}	x_{26}	x_{27}	x_{28}	x_{29}	x_{30}
1024210	VM1698-4	43,41	43,42	43,34	43,55	43,40	43,52	43,60	43,38	43,55	43,51
1024210	VM1698-4	357,25	358,75	362,50	366,25	361,50	363,25	363,00	365,75	370,50	365,50

Char.No.	Char.Descr.	x_{31}	x_{32}	x_{33}	x_{34}	x_{35}	x_{36}	x_{37}	x_{38}	x_{39}	x_{40}
1024210	VM1698-4	43,39	43,38	43,38	43,35	43,39	43,30	43,39	43,58	43,70	43,35
1024210	VM1698-4	361,50	360,50	360,75	355,75	359,25	359,75	359,50	369,00	365,50	356,00

Char.No.	Char.Descr.	x_{41}	x_{42}	x_{43}	x_{44}	x_{45}	x_{46}	x_{47}	x_{48}	x_{49}	x_{50}
1024210	VM1698-4	43,57	43,58	43,34	43,31	43,39	43,58	43,48	43,41	43,46	43,41
1024210	VM1698-4	364,50	362,50	357,25	359,25	360,75	367,00	361,75	358,50	363,00	362,75

Char.No.	Char.Descr.	x_{51}	x_{52}	x_{53}	x_{54}	x_{55}	x_{56}	x_{57}	x_{58}	x_{59}	x_{60}
1024210	VM1698-4	43,64	43,35	43,56	43,38	43,49	43,48	43,45	43,56	43,63	43,54
1024210	VM1698-4	367,00	359,25	366,00	361,00	364,75	364,25	367,75	373,00	367,00	367,75

Char.No.	Char.Descr.	x_{61}	x_{62}	x_{63}	x_{64}	x_{65}	x_{66}	x_{67}	x_{68}	x_{69}	x_{70}
1024210	VM1698-4	43,43	43,38	43,58	43,54	43,53	43,40	43,46	43,61	43,57	43,58
1024210	VM1698-4	357,00	357,00	361,00	361,75	360,25	358,00	360,50	364,75	363,75	366,00

Char.No.	Char.Descr.	x_{71}	x_{72}	x_{73}	x_{74}	x_{75}	x_{76}	x_{77}	x_{78}	x_{79}	x_{80}
1024210	VM1698-4	43,65	43,58	43,65	43,77	43,35	43,46	43,43	43,53	43,44	43,35
1024210	VM1698-4	362,75	364,00	364,25	364,75	363,75	364,50	361,75	362,25	359,25	354,50

Machine Capability Study
Control System

Plant	ATG Westhausen		Operator Name	Sünder	Date 04.02.2022

Ser.No.	756029_g	Characteristic			
Type	1BD-1B060A-1K2D-1VK2D	Char.Descr.	VM1698-4	Inspection Val.	43,46
Ord. No.	1BD53T2O-A	Ser.No.	1024210	LSL	40,42
				USL	46,50
Remark	TQ 80% soft +/-7% * TQ-Cal.: 60.0 Nm; Cur-Cal.: 3.8391 Nm/A; Speed: 700/50 rpm;				

Char.No.	Char.Descr.	x_{81}	x_{82}	x_{83}	x_{84}	x_{85}	x_{86}	x_{87}	x_{88}	x_{89}	x_{90}
1024210	VM1698-4	43,50	43,41	43,36	43,49	43,39	43,44	43,41	43,66	43,32	43,59
1024210	VM1698-4	361,50	360,00	360,00	361,00	360,75	362,75	360,25	367,25	360,00	364,75

Char.No.	Char.Descr.	x_{91}	x_{92}	x_{93}	x_{94}	x_{95}	x_{96}	x_{97}	x_{98}	x_{99}	x_{100}
1024210	VM1698-4	43,54	43,62	43,52	43,47	43,49	43,56	43,46	43,60	43,43	43,48
1024210	VM1698-4	363,50	366,25	370,00	365,25	363,50	370,75	365,75	372,00	362,50	363,00

Machine Capability Study
Tool System

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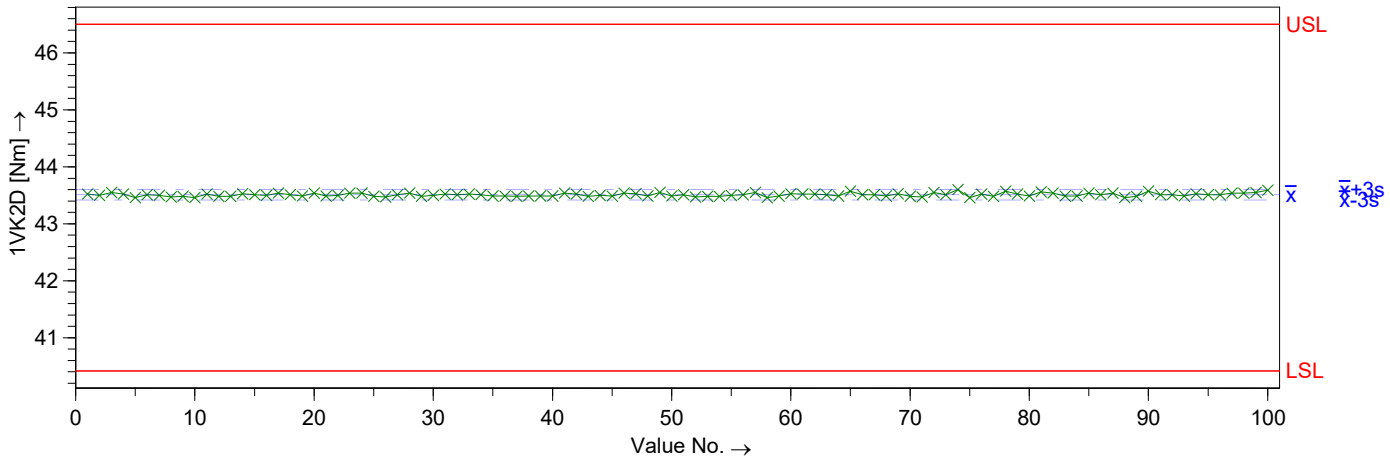
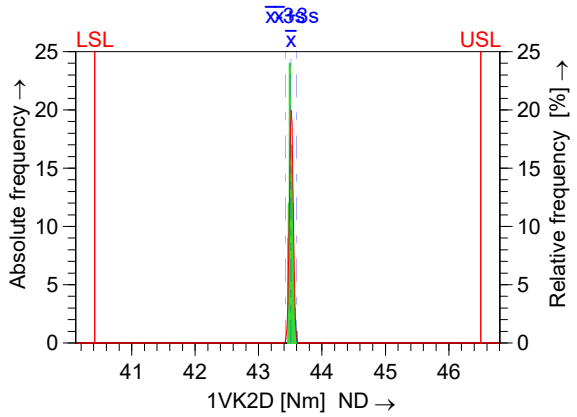
Plant	ATG Westhausen	Operator Name	Sünder
Date	04.02.2022		

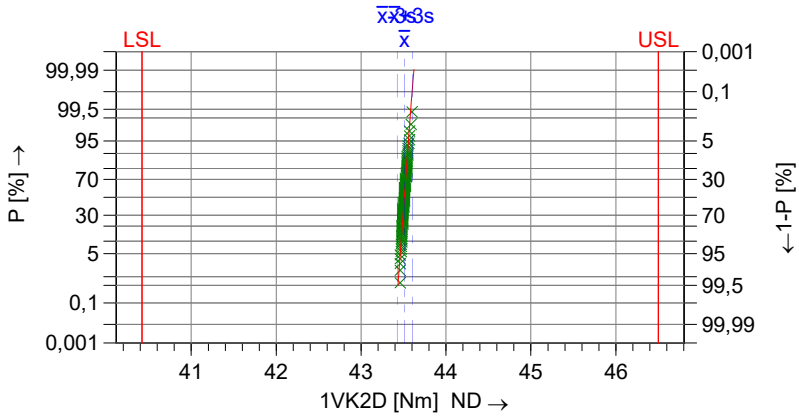
Ord. No.	1BD53T2O-A	Part type	1BD-1B060A-1K2D-1VK2D	Contr.item	yes
Serial No.	756029_g	Char.Descr.	1VK2D	Inspection Val. 43,46 3,04	USL 46,50
		Serial No.	200694_1	Unit Nm -3,04	LSL 40,42
Char.Type	variable			Tolerance value 7 %	Decimal Pl. 2
Cust.Name	Cleco	Reference System	VM1698-4	Test Electronic	MPRO400GCD-P
Contr.No.	Homologation	Reference Transducer	50 / 1024729	nges.	100

Evaluation from 04.02.2022 07:46:53 to 04.02.2022 08:13:41

Rem. TQ 80% soft +/-7% * TQ-Cal.: 60.0 Nm; Cur-Cal.: 3.8391 Nm/A; Speed: 700/50 rpm;







Drawing Values		Collected Values		Statistics	
T_m	43.46			$\bar{x}$	43.5098
LSL	40.42	x_{min}	43.46	$\bar{x}$-3s	43.4210
USL	46.50	x_{max}	43.60	$\bar{x}$+3s	43.5986
T	6.08	R	0.14	6s	0.1777
		$n_{<T>}$	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	34.22
Critical capability index	=	C_{mk}	33.66

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 04.02.2022

Ser.No.	756029_g	Characteristic			
Type	1BD-1B060A-1K2D-1VK2D	Char.Descr.	1VK2D	Inspection Val.	43,46
Ord. No.	1BD53T2O-A	Ser.No.	200694_1	LSL	40,42
				USL	46,50
Remark	TQ 80% soft +/-7% * TQ-Cal.: 60.0 Nm; Cur-Cal.: 3.8391 Nm/A; Speed: 700/50 rpm;				

Char.No.	Char.Descr.	x_1	x_2	x_3	x_4	x_5	x_6	x_7	x_8	x_9	x_{10}
200694_	1VK2D	43,52	43,50	43,55	43,52	43,46	43,51	43,50	43,47	43,48	43,46
200694_	1VK2D	357,00	359,00	361,00	358,00	363,00	360,00	363,00	364,00	369,00	364,00

Char.No.	Char.Descr.	x_{11}	x_{12}	x_{13}	x_{14}	x_{15}	x_{16}	x_{17}	x_{18}	x_{19}	x_{20}
200694_	1VK2D	43,52	43,48	43,48	43,53	43,51	43,50	43,54	43,51	43,49	43,54
200694_	1VK2D	356,00	363,00	365,00	365,00	363,00	368,00	366,00	367,00	364,00	355,00

Char.No.	Char.Descr.	x_{21}	x_{22}	x_{23}	x_{24}	x_{25}	x_{26}	x_{27}	x_{28}	x_{29}	x_{30}
200694_	1VK2D	43,49	43,50	43,54	43,54	43,48	43,47	43,51	43,54	43,48	43,50
200694_	1VK2D	357,00	359,00	363,00	365,00	362,00	361,00	361,00	367,00	370,00	365,00

Char.No.	Char.Descr.	x_{31}	x_{32}	x_{33}	x_{34}	x_{35}	x_{36}	x_{37}	x_{38}	x_{39}	x_{40}
200694_	1VK2D	43,52	43,51	43,52	43,51	43,49	43,49	43,48	43,49	43,49	43,49
200694_	1VK2D	363,00	361,00	362,00	359,00	359,00	361,00	359,00	367,00	364,00	356,00

Char.No.	Char.Descr.	x_{41}	x_{42}	x_{43}	x_{44}	x_{45}	x_{46}	x_{47}	x_{48}	x_{49}	x_{50}
200694_	1VK2D	43,54	43,52	43,48	43,50	43,49	43,54	43,53	43,49	43,55	43,49
200694_	1VK2D	364,00	361,00	357,00	360,00	361,00	367,00	361,00	358,00	363,00	362,00

Char.No.	Char.Descr.	x_{51}	x_{52}	x_{53}	x_{54}	x_{55}	x_{56}	x_{57}	x_{58}	x_{59}	x_{60}
200694_	1VK2D	43,51	43,47	43,48	43,48	43,50	43,51	43,55	43,46	43,49	43,53
200694_	1VK2D	366,00	360,00	365,00	361,00	364,00	364,00	369,00	372,00	365,00	367,00

Char.No.	Char.Descr.	x_{61}	x_{62}	x_{63}	x_{64}	x_{65}	x_{66}	x_{67}	x_{68}	x_{69}	x_{70}
200694_	1VK2D	43,52	43,52	43,51	43,49	43,57	43,51	43,51	43,49	43,53	43,48
200694_	1VK2D	357,00	357,00	360,00	361,00	360,00	358,00	360,00	363,00	363,00	365,00

Char.No.	Char.Descr.	x_{71}	x_{72}	x_{73}	x_{74}	x_{75}	x_{76}	x_{77}	x_{78}	x_{79}	x_{80}
200694_	1VK2D	43,47	43,55	43,51	43,60	43,46	43,52	43,48	43,57	43,52	43,49
200694_	1VK2D	361,00	364,00	362,00	363,00	364,00	364,00	361,00	363,00	360,00	354,00

Machine Capability Study
Tool System

Plant	ATG Westhausen		Operator Name	Sünder	Date 04.02.2022

Ser.No.	756029_g	Characteristic			
Type	1BD-1B060A-1K2D-1VK2D	Char.Descr.	1VK2D	Inspection Val.	43,46
Ord. No.	1BD53T2O-A	Ser.No.	200694_1	LSL	40,42
				USL	46,50
Remark	TQ 80% soft +/-7% * TQ-Cal.: 60.0 Nm; Cur-Cal.: 3.8391 Nm/A; Speed: 700/50 rpm;				

Char.No.	Char.Descr.	x_{81}	x_{82}	x_{83}	x_{84}	x_{85}	x_{86}	x_{87}	x_{88}	x_{89}	x_{90}
200694_	1VK2D	43,56	43,54	43,49	43,49	43,54	43,51	43,54	43,46	43,48	43,57
200694_	1VK2D	361,00	360,00	361,00	361,00	361,00	363,00	361,00	366,00	361,00	364,00

Char.No.	Char.Descr.	x_{91}	x_{92}	x_{93}	x_{94}	x_{95}	x_{96}	x_{97}	x_{98}	x_{99}	x_{100}
200694_	1VK2D	43,51	43,51	43,49	43,53	43,51	43,51	43,54	43,54	43,55	43,59
200694_	1VK2D	363,00	365,00	369,00	365,00	364,00	369,00	365,00	370,00	363,00	363,00

Machine Capability Study
Tool System

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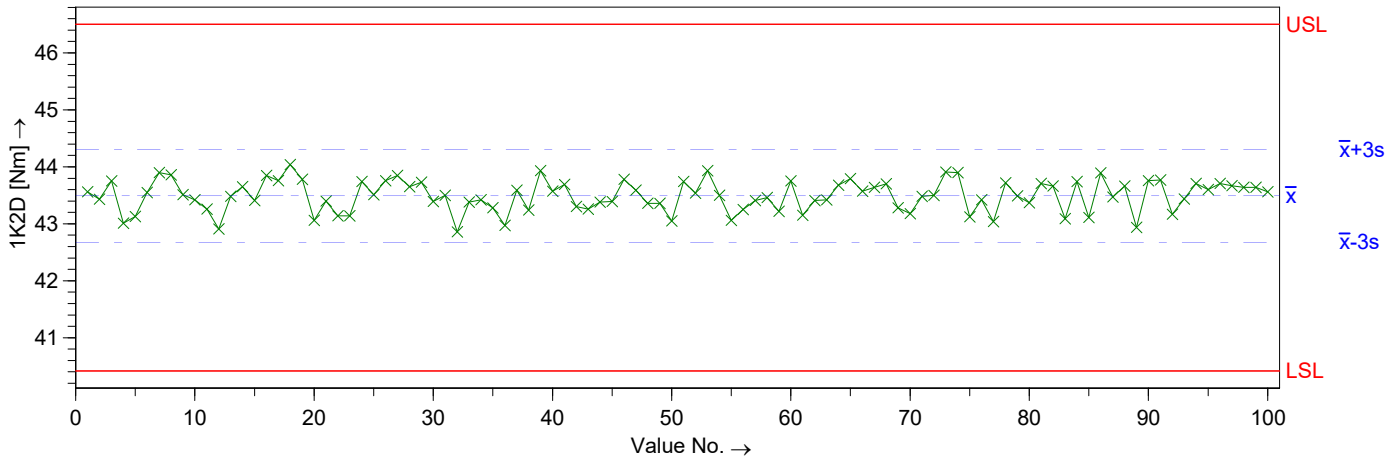
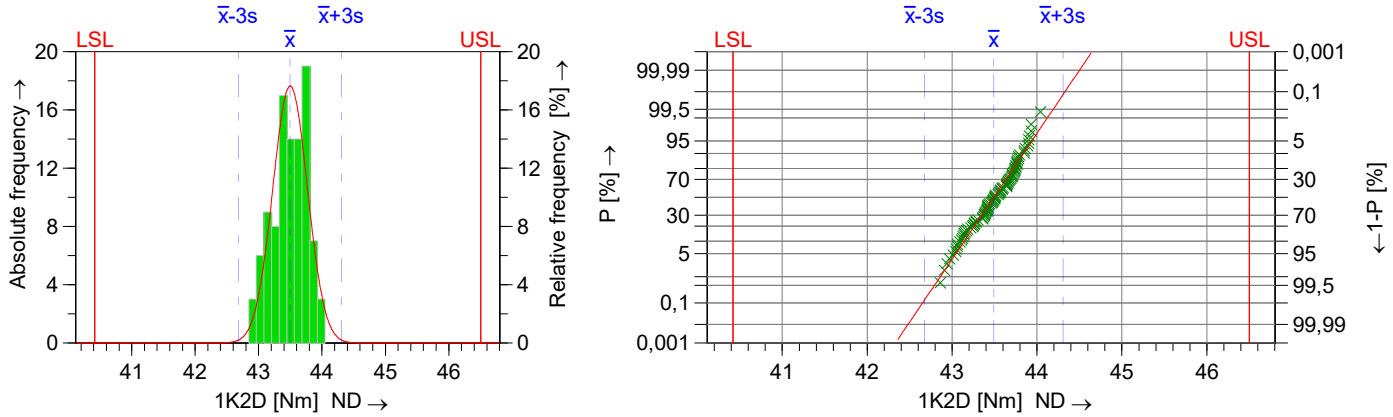
Plant	ATG Westhausen	Operator Name	Sünder
Date	04.02.2022		

Ord. No.	1BD53T2O-A	Part type	1BD-1B060A-1K2D-1VK2D	Contr.item	yes
Serial No.	756029_g	Char.Descr.	1K2D	Inspection Val. 43,46 3,04	USL 46,50
		Serial No.	202853	Unit Nm -3,04	LSL 40,42
Char.Type	variable			Tolerance value 7 %	Decimal Pl. 2
Cust.Name	Cleco	Reference System	VM1698-4	Test Electronic	MPRO400GCD-P
Contr.No.	Homologation	Reference Transducer	50 / 1024729	nges.	100

Evaluation from 04.02.2022 07:46:53 to 04.02.2022 08:13:41

Rem. TQ 80% soft +/-7% * TQ-Cal.: 60.0 Nm; Cur-Cal.: 3.8391 Nm/A; Speed: 700/50 rpm;





Drawing Values		Collected Values		Statistics	
T_m	43.46			$\bar{x}$	43.4910
LSL	40.42	x_{min}	42.86	$\bar{x}$-3s	42.6772
USL	46.50	x_{max}	44.04	$\bar{x}$+3s	44.3048
T	6.08	R	1.18	6s	1.6277
		$n_{<T>}$	100	$p_{<T>}$	100.00000 %
		$n_{>USL}$	0	$p_{>USL}$	0.00000%
		$n_{<LSL}$	0	$p_{<LSL}$	0.00000%
		n_{eff}	100		
		n_{tot}	100		

Model distribution			Normal Distribution
Calculation method			M1 1.4 $\hat{\sigma} = s_{tot}$
Potential Capability index	=	C_m	3.74
Critical capability index	=	C_{mk}	3.70

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

APEX VDI/VDE 2647 V0.1

Machine Capability Study
Tool System

Plant	ATG Westhausen		Operator Name	Sünder	Date 04.02.2022

Ser.No.	756029_g	Characteristic			
Type	1BD-1B060A-1K2D-1VK2D	Char.Descr.	1K2D	Inspection Val.	43,46
Ord. No.	1BD53T2O-A	Ser.No.	202853	LSL	40,42
				USL	46,50
Remark	TQ 80% soft +/-7% * TQ-Cal.: 60.0 Nm; Cur-Cal.: 3.8391 Nm/A; Speed: 700/50 rpm;				

Char.No.	Char.Descr.	x_1	x_2	x_3	x_4	x_5	x_6	x_7	x_8	x_9	x_{10}
202853	1K2D	43,56	43,43	43,75	43,01	43,13	43,55	43,90	43,86	43,51	43,42
202853	1K2D	357,00	359,00	361,00	358,00	363,00	360,00	363,00	364,00	369,00	364,00

Char.No.	Char.Descr.	x_{11}	x_{12}	x_{13}	x_{14}	x_{15}	x_{16}	x_{17}	x_{18}	x_{19}	x_{20}
202853	1K2D	43,26	42,91	43,48	43,65	43,41	43,85	43,76	44,04	43,78	43,06
202853	1K2D	356,00	363,00	365,00	365,00	363,00	368,00	366,00	367,00	364,00	355,00

Char.No.	Char.Descr.	x_{21}	x_{22}	x_{23}	x_{24}	x_{25}	x_{26}	x_{27}	x_{28}	x_{29}	x_{30}
202853	1K2D	43,40	43,14	43,14	43,74	43,51	43,76	43,85	43,65	43,73	43,39
202853	1K2D	357,00	359,00	363,00	365,00	362,00	361,00	361,00	367,00	370,00	365,00

Char.No.	Char.Descr.	x_{31}	x_{32}	x_{33}	x_{34}	x_{35}	x_{36}	x_{37}	x_{38}	x_{39}	x_{40}
202853	1K2D	43,50	42,86	43,38	43,42	43,28	42,97	43,59	43,24	43,93	43,57
202853	1K2D	363,00	361,00	362,00	359,00	359,00	361,00	359,00	367,00	364,00	356,00

Char.No.	Char.Descr.	x_{41}	x_{42}	x_{43}	x_{44}	x_{45}	x_{46}	x_{47}	x_{48}	x_{49}	x_{50}
202853	1K2D	43,69	43,30	43,26	43,38	43,39	43,78	43,59	43,36	43,36	43,05
202853	1K2D	364,00	361,00	357,00	360,00	361,00	367,00	361,00	358,00	363,00	362,00

Char.No.	Char.Descr.	x_{51}	x_{52}	x_{53}	x_{54}	x_{55}	x_{56}	x_{57}	x_{58}	x_{59}	x_{60}
202853	1K2D	43,74	43,54	43,93	43,50	43,06	43,25	43,41	43,46	43,22	43,75
202853	1K2D	366,00	360,00	365,00	361,00	364,00	364,00	369,00	372,00	365,00	367,00

Char.No.	Char.Descr.	x_{61}	x_{62}	x_{63}	x_{64}	x_{65}	x_{66}	x_{67}	x_{68}	x_{69}	x_{70}
202853	1K2D	43,15	43,41	43,42	43,68	43,79	43,57	43,64	43,70	43,28	43,18
202853	1K2D	357,00	357,00	360,00	361,00	360,00	358,00	360,00	363,00	363,00	365,00

Char.No.	Char.Descr.	x_{71}	x_{72}	x_{73}	x_{74}	x_{75}	x_{76}	x_{77}	x_{78}	x_{79}	x_{80}
202853	1K2D	43,48	43,50	43,91	43,90	43,12	43,42	43,04	43,72	43,49	43,37
202853	1K2D	361,00	364,00	362,00	363,00	364,00	364,00	361,00	363,00	360,00	354,00

Machine Capability Study
Tool System

Plant	ATG Westhausen		Operator Name	Sünder	Date 04.02.2022

Ser.No.	756029_g	Characteristic			
Type	1BD-1B060A-1K2D-1VK2D	Char.Descr.	1K2D	Inspection Val.	43,46
Ord. No.	1BD53T2O-A	Ser.No.	202853	LSL	40,42
				USL	46,50
Remark	TQ 80% soft +/-7% * TQ-Cal.: 60.0 Nm; Cur-Cal.: 3.8391 Nm/A; Speed: 700/50 rpm;				

Char.No.	Char.Descr.	x_{81}	x_{82}	x_{83}	x_{84}	x_{85}	x_{86}	x_{87}	x_{88}	x_{89}	x_{90}
202853	1K2D	43,71	43,66	43,09	43,74	43,11	43,89	43,47	43,66	42,94	43,76
202853	1K2D	361,00	360,00	361,00	361,00	361,00	363,00	361,00	366,00	361,00	364,00

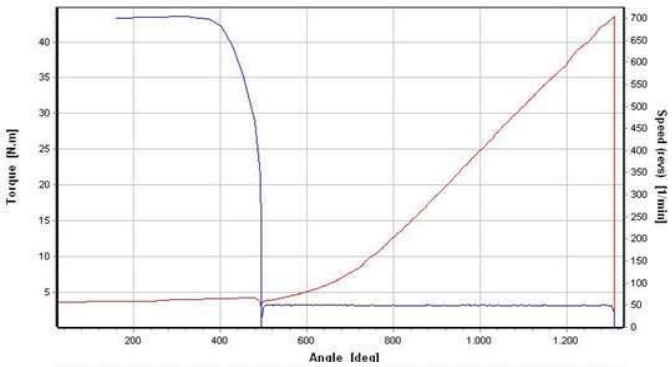
Char.No.	Char.Descr.	x_{91}	x_{92}	x_{93}	x_{94}	x_{95}	x_{96}	x_{97}	x_{98}	x_{99}	x_{100}
202853	1K2D	43,77	43,17	43,44	43,71	43,60	43,71	43,67	43,64	43,64	43,56
202853	1K2D	363,00	365,00	369,00	365,00	364,00	369,00	365,00	370,00	363,00	363,00

Torque graphs

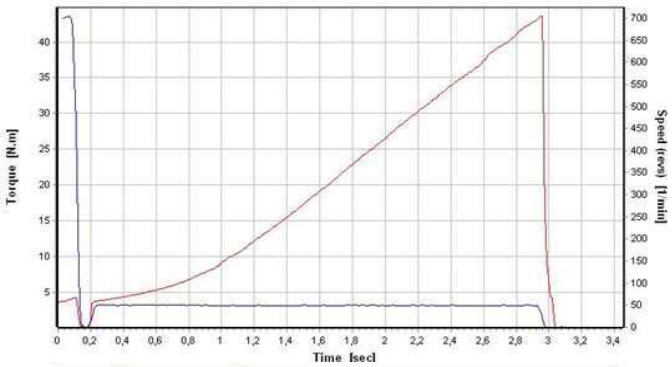
Model: **1BD-1B060A-1K2D-1VK2D**
Serial no: **756029**

Machine Capability Study 80 %

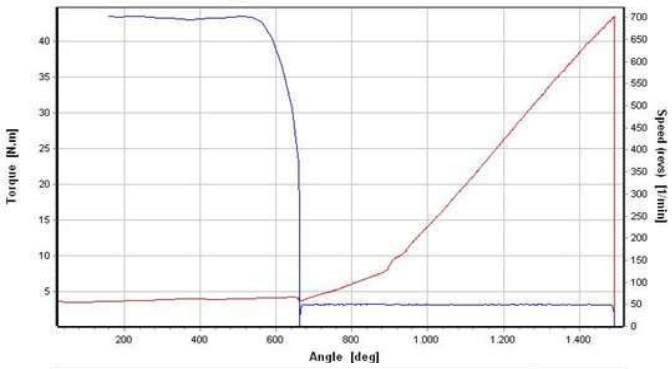
Angle degree: **360°**
Test torque: **43,5 Nm**



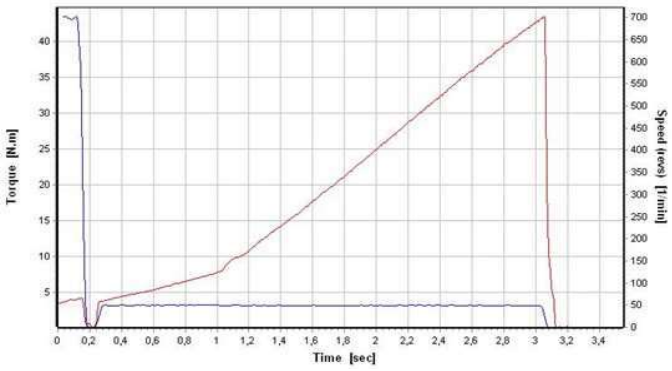
Value no. 1
Graph
Torque / Angle / Speed



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	7,1 %
Single-stage tightening system	☐	Speed 100 %	700 rpm

Manufacturer: Apex Tool Group Serial no: **756029**

Test torque: Tq max. 53,00 Nm

Hard joint (H)	320,83 Nm / Revolution	Angle degree	30°
Soft joint (L)	26,54 Nm / Revolution	Angle degree	360°

		H	L
a)	Tolerance down / up	49,29 56,71 Nm	49,29 - 56,71 Nm
	Tolerance down / up	7	7 %
	Average torque	53,47	53,07 Nm
	Standard deviation	0,13	0,13 Nm
	Torque scatter (99,73%)	0,78	0,80 Nm
	C_m	9,50	9,28
	C_{mk}	8,29	9,10

b)	Min. C_m hard/soft (lowest value)	9,28
	Min. C_{mk} hard/soft (lowest value)	8,29

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

Note:

Machine Capability Study
Control System

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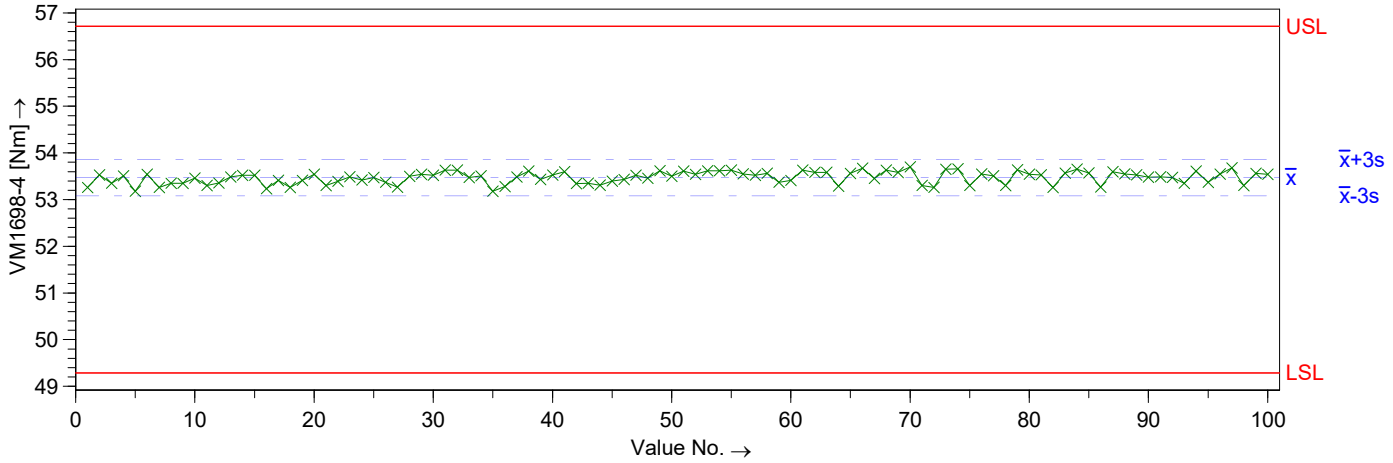
Plant ATG Westhausen		Operator Name Sünder	Date 03.02.2022

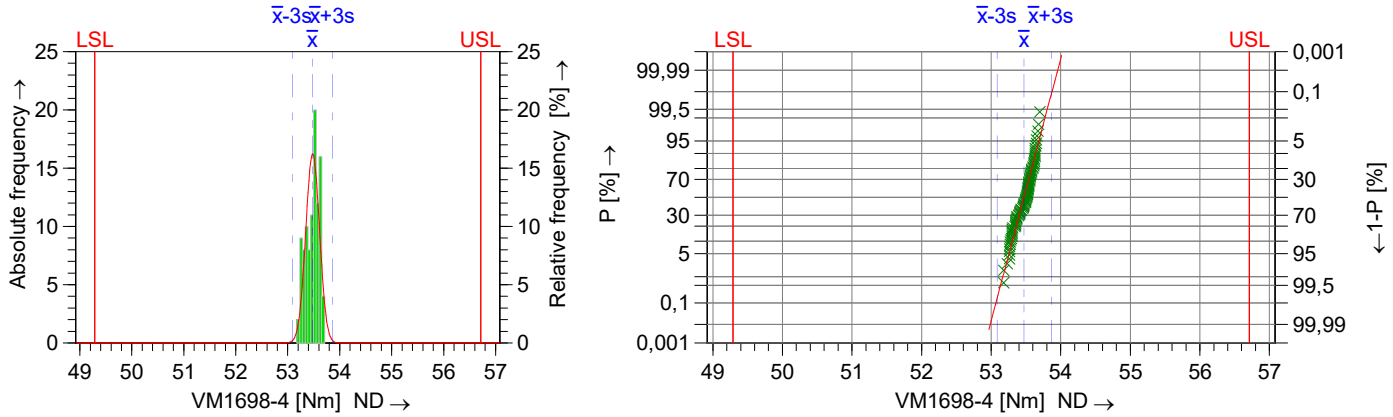
Ord. No. 1BD53T2O-A	Part type 1BD-1B060A-1K2D-1VK2D				Contr.item yes
Serial No. 756029_b	Char.Descr. VM1698-4	Inspection Val.	53,00	3,71	USL 56,71
	Serial No. 1024210	Unit	Nm	-3,71	LSL 49,29
Char.Type variable		Tolerance value	7 %		Decimal Pl. 2

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

Evaluation from 03.02.2022 13:18:47 to 03.02.2022 13:34:27

Rem. TQ 100% hard +/-7% * TQ-Cal.: 60.0 Nm; Cur-Cal.: 3.8391 Nm/A; Speed: 700/50 rpm;





Drawing Values		Collected Values		Statistics	
T_m	53.00			$\bar{x}$	53.4713
LSL	49.29	x_{min}	53.18	$\bar{x}$-3s	53.0806
USL	56.71	x_{max}	53.70	$\bar{x}$+3s	53.8620
T	7.42	R	0.52	6s	0.7813
		$n_{<T>}$	100	$p_{<T>}$	100.00000 %
		$n_{>USL}$	0	$p_{>USL}$	0.00000%
		$n_{<LSL}$	0	$p_{<LSL}$	0.00000%
		n_{eff}	100		
		n_{tot}	100		

Model distribution			Normal Distribution
Calculation method			M1 1.4 $\hat{\sigma} = s_{tot}$
Potential Capability index	=	C_m	9.50
Critical capability index	=	C_{mk}	8.29

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 03.02.2022

Ser.No.	756029_b	Characteristic			
Type	1BD-1B060A-1K2D-1VK2D	Char.Descr.	VM1698-4	Inspection Val.	53,00
Ord. No.	1BD53T2O-A	Ser.No.	1024210	LSL	49,29
				USL	56,71
Remark	TQ 100% hard +/-7% * TQ-Cal.: 60.0 Nm; Cur-Cal.: 3.8391 Nm/A; Speed: 700/50 rpm;				

Char.No.	Char.Descr.	x_1	x_2	x_3	x_4	x_5	x_6	x_7	x_8	x_9	x_{10}
1024210	VM1698-4	53,26	53,53	53,35	53,51	53,18	53,54	53,26	53,35	53,35	53,46
1024210	VM1698-4	27,75	30,00	30,50	30,25	30,00	30,25	30,25	30,25	30,50	30,50

Char.No.	Char.Descr.	x_{11}	x_{12}	x_{13}	x_{14}	x_{15}	x_{16}	x_{17}	x_{18}	x_{19}	x_{20}
1024210	VM1698-4	53,30	53,36	53,49	53,52	53,52	53,23	53,41	53,26	53,41	53,54
1024210	VM1698-4	30,25	30,50	30,25	30,25	28,50	30,50	30,75	30,75	30,75	30,75

Char.No.	Char.Descr.	x_{21}	x_{22}	x_{23}	x_{24}	x_{25}	x_{26}	x_{27}	x_{28}	x_{29}	x_{30}
1024210	VM1698-4	53,30	53,39	53,49	53,42	53,47	53,37	53,27	53,50	53,54	53,52
1024210	VM1698-4	30,50	31,25	31,00	30,25	29,50	28,00	29,75	30,50	30,50	30,50

Char.No.	Char.Descr.	x_{31}	x_{32}	x_{33}	x_{34}	x_{35}	x_{36}	x_{37}	x_{38}	x_{39}	x_{40}
1024210	VM1698-4	53,63	53,63	53,47	53,51	53,18	53,28	53,49	53,61	53,43	53,53
1024210	VM1698-4	30,50	31,00	31,00	30,75	30,50	30,25	30,25	30,25	30,25	30,75

Char.No.	Char.Descr.	x_{41}	x_{42}	x_{43}	x_{44}	x_{45}	x_{46}	x_{47}	x_{48}	x_{49}	x_{50}
1024210	VM1698-4	53,60	53,34	53,35	53,31	53,40	53,43	53,52	53,46	53,62	53,50
1024210	VM1698-4	30,75	30,25	30,50	30,75	30,50	30,00	30,25	30,50	30,50	30,25

Char.No.	Char.Descr.	x_{51}	x_{52}	x_{53}	x_{54}	x_{55}	x_{56}	x_{57}	x_{58}	x_{59}	x_{60}
1024210	VM1698-4	53,61	53,54	53,62	53,62	53,63	53,55	53,52	53,56	53,37	53,41
1024210	VM1698-4	30,75	30,75	30,50	30,00	30,25	30,75	31,00	30,75	30,75	30,25

Char.No.	Char.Descr.	x_{61}	x_{62}	x_{63}	x_{64}	x_{65}	x_{66}	x_{67}	x_{68}	x_{69}	x_{70}
1024210	VM1698-4	53,63	53,58	53,58	53,29	53,56	53,67	53,45	53,63	53,58	53,70
1024210	VM1698-4	30,50	30,00	30,25	30,00	30,00	29,75	28,25	30,00	30,25	30,00

Char.No.	Char.Descr.	x_{71}	x_{72}	x_{73}	x_{74}	x_{75}	x_{76}	x_{77}	x_{78}	x_{79}	x_{80}
1024210	VM1698-4	53,30	53,26	53,65	53,66	53,30	53,55	53,51	53,30	53,64	53,54
1024210	VM1698-4	30,00	29,50	30,25	30,25	29,75	30,00	30,00	30,25	30,25	30,00

Machine Capability Study
Control System

Plant	ATG Westhausen		Operator Name	Sünder	Date 03.02.2022

Ser.No.	756029_b	Characteristic			
Type	1BD-1B060A-1K2D-1VK2D	Char.Descr.	VM1698-4	Inspection Val.	53,00
Ord. No.	1BD53T2O-A	Ser.No.	1024210	LSL	49,29
				USL	56,71
Remark	TQ 100% hard +/-7% * TQ-Cal.: 60.0 Nm; Cur-Cal.: 3.8391 Nm/A; Speed: 700/50 rpm;				

Char.No.	Char.Descr.	x_{81}	x_{82}	x_{83}	x_{84}	x_{85}	x_{86}	x_{87}	x_{88}	x_{89}	x_{90}
1024210	VM1698-4	53,53	53,26	53,57	53,65	53,57	53,27	53,60	53,55	53,53	53,48
1024210	VM1698-4	30,25	30,00	30,00	30,50	30,00	30,00	30,25	30,00	30,25	27,50

Char.No.	Char.Descr.	x_{91}	x_{92}	x_{93}	x_{94}	x_{95}	x_{96}	x_{97}	x_{98}	x_{99}	x_{100}
1024210	VM1698-4	53,49	53,47	53,35	53,61	53,37	53,55	53,68	53,30	53,56	53,54
1024210	VM1698-4	29,75	30,75	30,25	30,50	30,50	29,75	30,75	30,75	30,50	31,00

Machine Capability Study
Tool System

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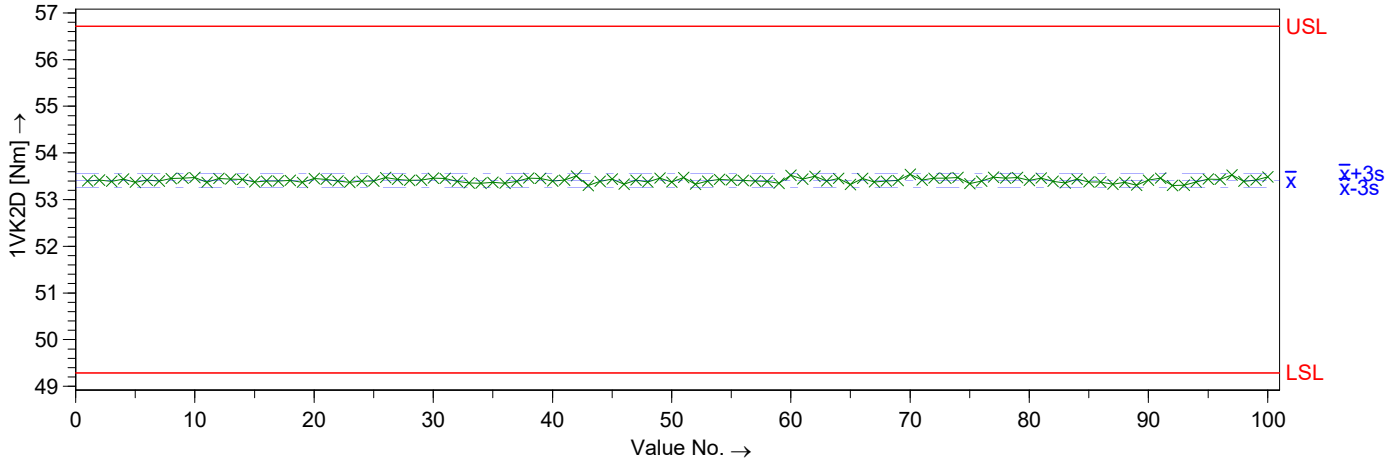
Plant	ATG Westhausen	Operator Name	Sünder
Date	03.02.2022		

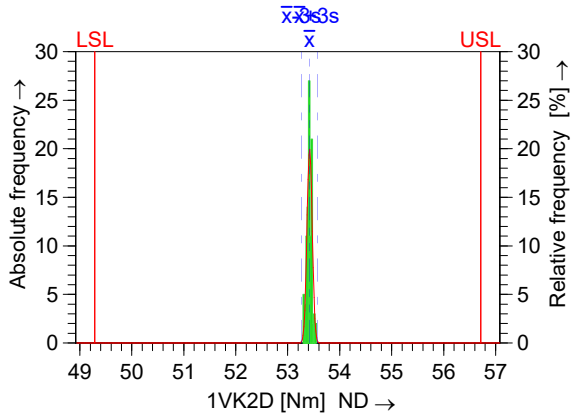
Ord. No.	1BD53T2O-A	Part type	1BD-1B060A-1K2D-1VK2D	Contr.item	yes
Serial No.	756029_b	Char.Descr.	1VK2D	Inspection Val. 53,00 3,71	USL 56,71
		Serial No.	200694_1	Unit Nm -3,71	LSL 49,29
Char.Type	variable			Tolerance value 7 %	Decimal Pl. 2

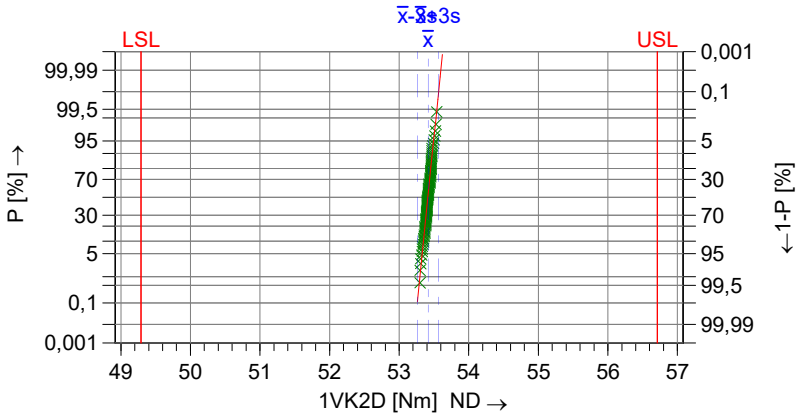
Cust.Name	Cleco	Reference System	VM1698-4	Test Electronic	MPRO400GCD-P
Contr.No.	Homologation	Reference Transducer	50 / 1024729	nges.	100

Evaluation from 03.02.2022 13:18:48 to 03.02.2022 13:34:27

Rem. TQ 100% hard +/-7% * TQ-Cal.: 60.0 Nm; Cur-Cal.: 3.8391 Nm/A; Speed: 700/50 rpm;







Drawing Values		Collected Values		Statistics	
T_m	53.00			$\bar{x}$	53.4128
LSL	49.29	x_{min}	53.30	$\bar{x}$-3s	53.2638
USL	56.71	x_{max}	53.54	$\bar{x}$+3s	53.5618
T	7.42	R	0.24	6s	0.2980
		$n_{<T>}$	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	24.90
Critical capability index	=	C_{mk}	22.13

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

APEX VDI/VDE 2647 V0.1

Apex Tool Group GmbH \\htwe0006\AppData\QW\QWE\MessWert\2022\756029_b1.DFD

Machine Capability Study
Tool System

Plant	ATG Westhausen		Operator Name	Sünder	Date 03.02.2022

Ser.No.	756029_b	Characteristic			
Type	1BD-1B060A-1K2D-1VK2D	Char.Descr.	1VK2D	Inspection Val.	53,00
Ord. No.	1BD53T2O-A	Ser.No.	200694_1	LSL	49,29
				USL	56,71
Remark	TQ 100% hard +/-7% * TQ-Cal.: 60.0 Nm; Cur-Cal.: 3.8391 Nm/A; Speed: 700/50 rpm;				

Char.No.	Char.Descr.	x_1	x_2	x_3	x_4	x_5	x_6	x_7	x_8	x_9	x_{10}
200694_	1VK2D	53,40	53,42	53,39	53,44	53,37	53,42	53,40	53,45	53,46	53,47
200694_	1VK2D	31,00	30,00	31,00	30,00	30,00	30,00	30,00	30,00	31,00	30,00

Char.No.	Char.Descr.	x_{11}	x_{12}	x_{13}	x_{14}	x_{15}	x_{16}	x_{17}	x_{18}	x_{19}	x_{20}
200694_	1VK2D	53,37	53,45	53,44	53,43	53,38	53,40	53,40	53,41	53,37	53,45
200694_	1VK2D	30,00	31,00	30,00	31,00	31,00	31,00	31,00	30,00	31,00	31,00

Char.No.	Char.Descr.	x_{21}	x_{22}	x_{23}	x_{24}	x_{25}	x_{26}	x_{27}	x_{28}	x_{29}	x_{30}
200694_	1VK2D	53,43	53,40	53,37	53,40	53,40	53,47	53,43	53,41	53,42	53,46
200694_	1VK2D	31,00	31,00	31,00	30,00	30,00	30,00	30,00	30,00	31,00	31,00

Char.No.	Char.Descr.	x_{31}	x_{32}	x_{33}	x_{34}	x_{35}	x_{36}	x_{37}	x_{38}	x_{39}	x_{40}
200694_	1VK2D	53,45	53,39	53,36	53,35	53,37	53,35	53,39	53,46	53,45	53,40
200694_	1VK2D	31,00	31,00	31,00	31,00	31,00	31,00	31,00	31,00	31,00	31,00

Char.No.	Char.Descr.	x_{41}	x_{42}	x_{43}	x_{44}	x_{45}	x_{46}	x_{47}	x_{48}	x_{49}	x_{50}
200694_	1VK2D	53,42	53,51	53,30	53,39	53,44	53,33	53,42	53,38	53,46	53,38
200694_	1VK2D	31,00	31,00	31,00	31,00	31,00	30,00	30,00	31,00	31,00	31,00

Char.No.	Char.Descr.	x_{51}	x_{52}	x_{53}	x_{54}	x_{55}	x_{56}	x_{57}	x_{58}	x_{59}	x_{60}
200694_	1VK2D	53,47	53,33	53,40	53,43	53,42	53,41	53,40	53,39	53,35	53,52
200694_	1VK2D	31,00	31,00	30,00	30,00	30,00	31,00	31,00	31,00	31,00	30,00

Char.No.	Char.Descr.	x_{61}	x_{62}	x_{63}	x_{64}	x_{65}	x_{66}	x_{67}	x_{68}	x_{69}	x_{70}
200694_	1VK2D	53,44	53,50	53,40	53,45	53,32	53,45	53,38	53,40	53,41	53,54
200694_	1VK2D	30,00	30,00	31,00	30,00	30,00	30,00	30,00	30,00	30,00	31,00

Char.No.	Char.Descr.	x_{71}	x_{72}	x_{73}	x_{74}	x_{75}	x_{76}	x_{77}	x_{78}	x_{79}	x_{80}
200694_	1VK2D	53,42	53,46	53,46	53,47	53,34	53,40	53,48	53,46	53,47	53,41
200694_	1VK2D	30,00	30,00	30,00	31,00	30,00	30,00	30,00	30,00	30,00	30,00

Machine Capability Study
Tool System

Plant	ATG Westhausen		Operator Name	Sünder	Date 03.02.2022

Ser.No.	756029_b	Characteristic			
Type	1BD-1B060A-1K2D-1VK2D	Char.Descr.	1VK2D	Inspection Val.	53,00
Ord. No.	1BD53T2O-A	Ser.No.	200694_1	LSL	49,29
				USL	56,71
Remark	TQ 100% hard +/-7% * TQ-Cal.: 60.0 Nm; Cur-Cal.: 3.8391 Nm/A; Speed: 700/50 rpm;				

Char.No.	Char.Descr.	x_{81}	x_{82}	x_{83}	x_{84}	x_{85}	x_{86}	x_{87}	x_{88}	x_{89}	x_{90}
200694_	1VK2D	53,46	53,39	53,36	53,44	53,38	53,38	53,33	53,37	53,31	53,42
200694_	1VK2D	31,00	30,00	30,00	30,00	30,00	30,00	30,00	30,00	30,00	30,00

Char.No.	Char.Descr.	x_{91}	x_{92}	x_{93}	x_{94}	x_{95}	x_{96}	x_{97}	x_{98}	x_{99}	x_{100}
200694_	1VK2D	53,46	53,30	53,31	53,38	53,44	53,43	53,53	53,39	53,42	53,49
200694_	1VK2D	30,00	31,00	30,00	31,00	31,00	31,00	31,00	31,00	31,00	31,00

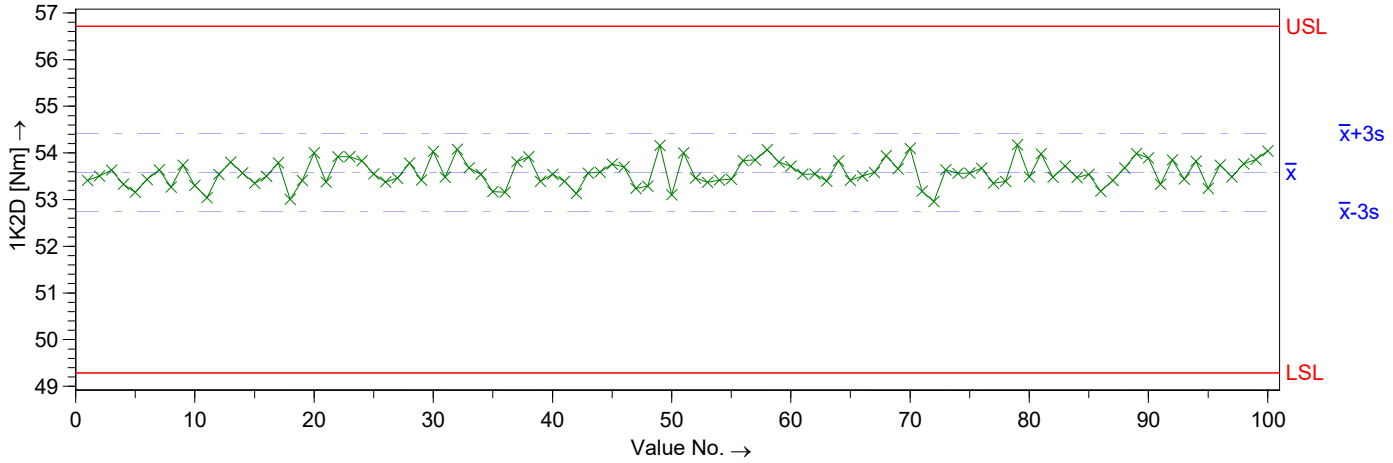
Machine Capability Study
Tool System

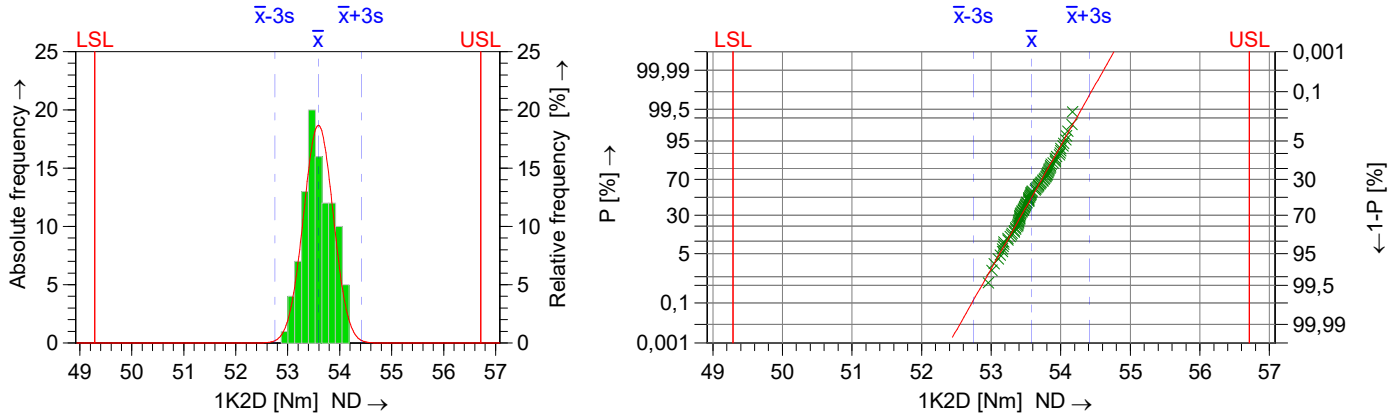
Plant ATG Westhausen		Operator Name Sünder	Date 03.02.2022

Ord. No. 1BD53T2O-A	Part type 1BD-1B060A-1K2D-1VK2D				Contr.item yes
Serial No. 756029_b	Char.Descr. 1K2D	Inspection Val.	53,00	3,71	USL 56,71
	Serial No. 202853	Unit	Nm	-3,71	LSL 49,29
Char.Type variable		Tolerance value	7 %		Decimal Pl. 2
Cust.Name Cleco	Reference System VM1698-4	Test Electronic MPRO400GCD-P			
Contr.No. Homologation	Reference Transducer 50 / 1024729	nges. 100			

Evaluation from 03.02.2022 13:18:48 to 03.02.2022 13:34:27

Rem. TQ 100% hard +/-7% * TQ-Cal.: 60.0 Nm; Cur-Cal.: 3.8391 Nm/A; Speed: 700/50 rpm;





Drawing Values		Collected Values		Statistics	
T_m	53.00			$\bar{x}$	53.5818
LSL	49.29	x_{min}	52.96	$\bar{x}$-3s	52.7491
USL	56.71	x_{max}	54.17	$\bar{x}$+3s	54.4145
T	7.42	R	1.21	6s	1.6654
		$n_{<T>}$	100	$p_{<T>}$	100.00000 %
		$n_{>USL}$	0	$p_{>USL}$	0.00000%
		$n_{<LSL}$	0	$p_{<LSL}$	0.00000%
		n_{eff}	100		
		n_{tot}	100		

Model distribution			Normal Distribution
Calculation method			$M1_{1.4}$ $\hat{\sigma} = s_{tot}$
Potential Capability index	=	C_m	4.46
Critical capability index	=	C_{mk}	3.76

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

APEX VDI/VDE 2647 V0.1

Machine Capability Study
Tool System

Plant	ATG Westhausen		Operator Name	Sünder	Date 03.02.2022

Ser.No.	756029_b	Characteristic			
Type	1BD-1B060A-1K2D-1VK2D	Char.Descr.	1K2D	Inspection Val.	53,00
Ord. No.	1BD53T2O-A	Ser.No.	202853	LSL	49,29
				USL	56,71
Remark	TQ 100% hard +/-7% * TQ-Cal.: 60.0 Nm; Cur-Cal.: 3.8391 Nm/A; Speed: 700/50 rpm;				

Char.No.	Char.Descr.	x_1	x_2	x_3	x_4	x_5	x_6	x_7	x_8	x_9	x_{10}
202853	1K2D	53,41	53,51	53,63	53,33	53,16	53,43	53,64	53,27	53,74	53,30
202853	1K2D	31,00	30,00	31,00	30,00	30,00	30,00	30,00	30,00	31,00	30,00

Char.No.	Char.Descr.	x_{11}	x_{12}	x_{13}	x_{14}	x_{15}	x_{16}	x_{17}	x_{18}	x_{19}	x_{20}
202853	1K2D	53,04	53,54	53,80	53,57	53,35	53,50	53,79	53,01	53,41	54,00
202853	1K2D	30,00	31,00	30,00	31,00	31,00	31,00	31,00	30,00	31,00	31,00

Char.No.	Char.Descr.	x_{21}	x_{22}	x_{23}	x_{24}	x_{25}	x_{26}	x_{27}	x_{28}	x_{29}	x_{30}
202853	1K2D	53,38	53,92	53,92	53,83	53,55	53,38	53,46	53,78	53,42	54,03
202853	1K2D	31,00	31,00	31,00	30,00	30,00	30,00	30,00	30,00	31,00	31,00

Char.No.	Char.Descr.	x_{31}	x_{32}	x_{33}	x_{34}	x_{35}	x_{36}	x_{37}	x_{38}	x_{39}	x_{40}
202853	1K2D	53,48	54,08	53,68	53,54	53,17	53,16	53,81	53,92	53,39	53,54
202853	1K2D	31,00	31,00	31,00	31,00	31,00	31,00	31,00	31,00	31,00	31,00

Char.No.	Char.Descr.	x_{41}	x_{42}	x_{43}	x_{44}	x_{45}	x_{46}	x_{47}	x_{48}	x_{49}	x_{50}
202853	1K2D	53,39	53,13	53,57	53,59	53,76	53,70	53,24	53,29	54,16	53,10
202853	1K2D	31,00	31,00	31,00	31,00	31,00	30,00	30,00	31,00	31,00	31,00

Char.No.	Char.Descr.	x_{51}	x_{52}	x_{53}	x_{54}	x_{55}	x_{56}	x_{57}	x_{58}	x_{59}	x_{60}
202853	1K2D	54,00	53,46	53,37	53,42	53,44	53,84	53,85	54,07	53,80	53,71
202853	1K2D	31,00	31,00	30,00	30,00	30,00	31,00	31,00	31,00	31,00	30,00

Char.No.	Char.Descr.	x_{61}	x_{62}	x_{63}	x_{64}	x_{65}	x_{66}	x_{67}	x_{68}	x_{69}	x_{70}
202853	1K2D	53,54	53,55	53,40	53,83	53,41	53,51	53,58	53,94	53,66	54,10
202853	1K2D	30,00	30,00	31,00	30,00	30,00	30,00	30,00	30,00	30,00	31,00

Char.No.	Char.Descr.	x_{71}	x_{72}	x_{73}	x_{74}	x_{75}	x_{76}	x_{77}	x_{78}	x_{79}	x_{80}
202853	1K2D	53,18	52,96	53,64	53,56	53,57	53,67	53,35	53,39	54,17	53,49
202853	1K2D	30,00	30,00	30,00	31,00	30,00	30,00	30,00	30,00	30,00	30,00

Machine Capability Study
Tool System

Plant	ATG Westhausen		Operator Name	Sünder	Date 03.02.2022

Ser.No.	756029_b	Characteristic			
Type	1BD-1B060A-1K2D-1VK2D	Char.Descr.	1K2D	Inspection Val.	53,00
Ord. No.	1BD53T2O-A	Ser.No.	202853	LSL	49,29
				USL	56,71
Remark	TQ 100% hard +/-7% * TQ-Cal.: 60.0 Nm; Cur-Cal.: 3.8391 Nm/A; Speed: 700/50 rpm;				

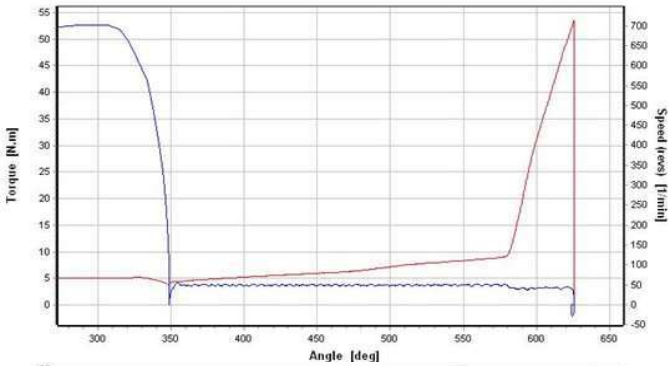
Char.No.	Char.Descr.	x_{81}	x_{82}	x_{83}	x_{84}	x_{85}	x_{86}	x_{87}	x_{88}	x_{89}	x_{90}
202853	1K2D	53,98	53,48	53,72	53,47	53,54	53,18	53,41	53,68	53,99	53,89
202853	1K2D	31,00	30,00	30,00	30,00	30,00	30,00	30,00	30,00	30,00	30,00

Char.No.	Char.Descr.	x_{91}	x_{92}	x_{93}	x_{94}	x_{95}	x_{96}	x_{97}	x_{98}	x_{99}	x_{100}
202853	1K2D	53,33	53,85	53,44	53,82	53,24	53,74	53,49	53,77	53,86	54,04
202853	1K2D	30,00	31,00	30,00	31,00	31,00	31,00	31,00	31,00	31,00	31,00

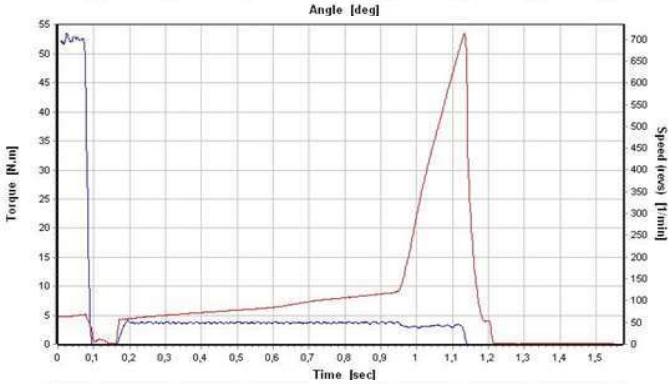
Torque graphs

Model: **1BD-1B060A-1K2D-1VK2D**
Serial no: **756029**

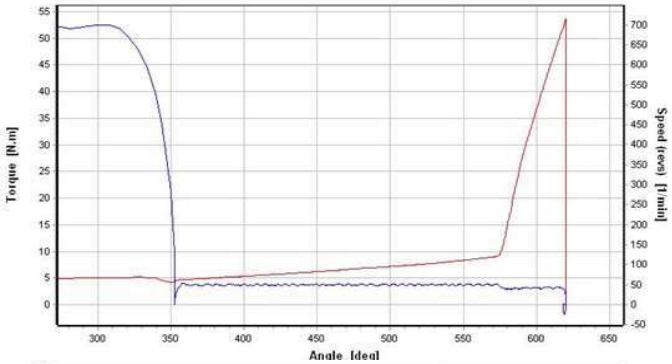
Machine Capability Study 100 %
Angle degree: **30°**
Test torque: **53,0 Nm**



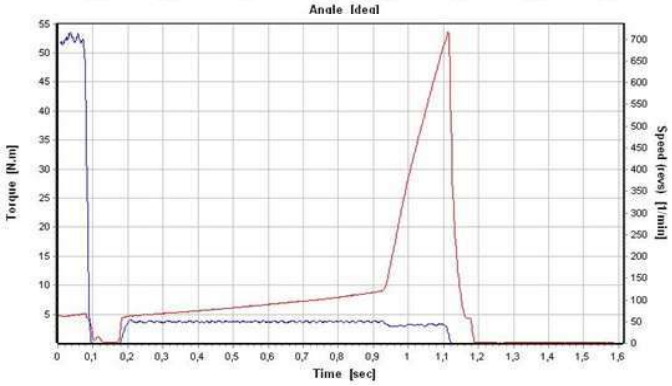
Value no. 1
Graph
Torque / Angle / Speed



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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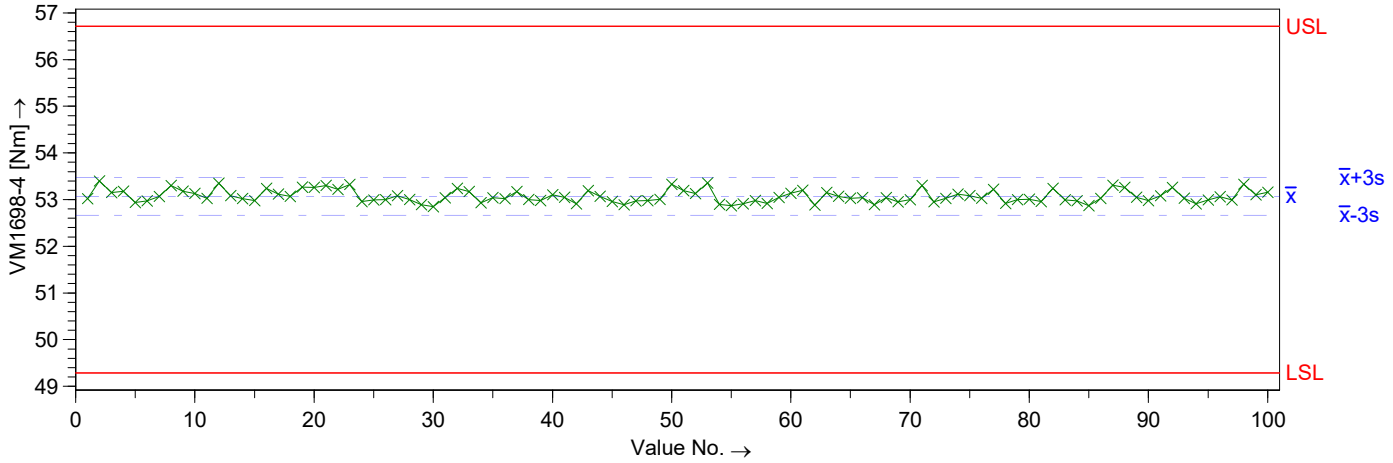
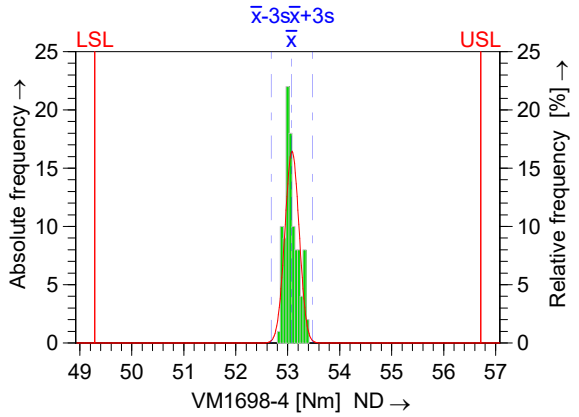
Plant	ATG Westhausen	Operator Name	Sünder
Date	03.02.2022		

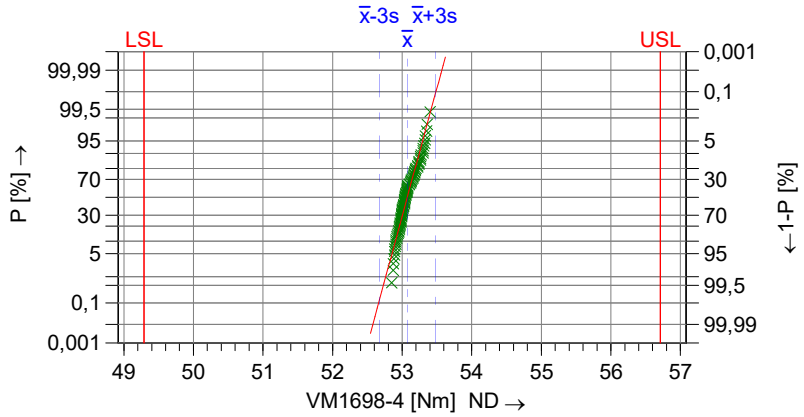
Ord. No.	1BD53T2O-A	Part type	1BD-1B060A-1K2D-1VK2D	Contr.item	yes
Serial No.	756029_a	Char.Descr.	VM1698-4	Inspection Val. 53,00 3,71	USL 56,71
		Serial No.	1024210	Unit Nm -3,71	LSL 49,29
Char.Type	variable			Tolerance value 7 %	Decimal Pl. 2
Cust.Name	Cleco	Reference System	VM1698-4	Test Electronic	MPRO400GCD-P
Contr.No.	Homologation	Reference Transducer	50 / 1024729	nges.	100

Evaluation from 03.02.2022 15:30:32 to 03.02.2022 17:20:02

Rem. TQ 100% soft +/-7% * TQ-Cal.: 60.0 Nm; Cur-Cal.: 3.8391 Nm/A; Speed: 700/50 rpm;







Drawing Values		Collected Values		Statistics	
T_m	53.00			$\bar{x}$	53.0735
LSL	49.29	x_{min}	52.85	$\bar{x}$-3s	52.6737
USL	56.71	x_{max}	53.40	$\bar{x}$+3s	53.4733
T	7.42	R	0.55	6s	0.7996
		$n_{<T>}$	100	$p_{<T>}$	100.00000 %
		$n_{>USL}$	0	$p_{>USL}$	0.00000%
		$n_{<LSL}$	0	$p_{<LSL}$	0.00000%
		n_{eff}	100		
		n_{tot}	100		

Model distribution			Normal Distribution
Calculation method			$M1_{1.4}$ $\hat{\sigma} = s_{tot}$
Potential Capability index	=	C_m	9.28
Critical capability index	=	C_{mk}	9.10

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

APEX VDI/VDE 2647 V0.1

Apex Tool Group GmbH \\htwe0006\AppData\QW\QWE\MessWert\2022\756029_aM.DFD

Machine Capability Study
Control System

Plant	ATG Westhausen		Operator Name	Sünder	Date 03.02.2022

Ser.No.	756029_a	Characteristic			
Type	1BD-1B060A-1K2D-1VK2D	Char.Descr.	VM1698-4	Inspection Val.	53,00
Ord. No.	1BD53T2O-A	Ser.No.	1024210	LSL	49,29
				USL	56,71
Remark	TQ 100% soft +/-7% * TQ-Cal.: 60.0 Nm; Cur-Cal.: 3.8391 Nm/A; Speed: 700/50 rpm;				

Char.No.	Char.Descr.	x_1	x_2	x_3	x_4	x_5	x_6	x_7	x_8	x_9	x_{10}
1024210	VM1698-4	53,02	53,40	53,15	53,18	52,94	52,97	53,07	53,30	53,18	53,13
1024210	VM1698-4	357,50	380,25	362,75	361,25	374,50	377,75	377,00	383,25	357,75	378,25

Char.No.	Char.Descr.	x_{11}	x_{12}	x_{13}	x_{14}	x_{15}	x_{16}	x_{17}	x_{18}	x_{19}	x_{20}
1024210	VM1698-4	53,03	53,35	53,08	53,02	52,98	53,24	53,12	53,07	53,27	53,26
1024210	VM1698-4	365,75	372,00	373,00	370,25	362,00	373,25	360,75	353,00	366,50	366,75

Char.No.	Char.Descr.	x_{21}	x_{22}	x_{23}	x_{24}	x_{25}	x_{26}	x_{27}	x_{28}	x_{29}	x_{30}
1024210	VM1698-4	53,30	53,22	53,32	52,96	52,99	53,00	53,08	53,00	52,89	52,85
1024210	VM1698-4	362,00	368,25	353,25	367,75	364,00	367,00	364,75	360,00	350,75	362,75

Char.No.	Char.Descr.	x_{31}	x_{32}	x_{33}	x_{34}	x_{35}	x_{36}	x_{37}	x_{38}	x_{39}	x_{40}
1024210	VM1698-4	53,04	53,24	53,17	52,93	53,04	53,02	53,17	53,00	52,98	53,10
1024210	VM1698-4	362,25	357,25	350,25	367,00	364,25	364,75	363,75	363,50	358,00	358,75

Char.No.	Char.Descr.	x_{41}	x_{42}	x_{43}	x_{44}	x_{45}	x_{46}	x_{47}	x_{48}	x_{49}	x_{50}
1024210	VM1698-4	53,05	52,91	53,19	53,07	52,96	52,89	52,97	52,98	53,01	53,33
1024210	VM1698-4	360,75	356,25	363,00	369,75	364,50	359,75	360,50	358,00	358,50	365,75

Char.No.	Char.Descr.	x_{51}	x_{52}	x_{53}	x_{54}	x_{55}	x_{56}	x_{57}	x_{58}	x_{59}	x_{60}
1024210	VM1698-4	53,19	53,13	53,36	52,90	52,87	52,91	52,98	52,92	53,05	53,14
1024210	VM1698-4	368,00	365,50	358,50	360,25	358,25	358,75	357,25	356,75	361,75	361,25

Char.No.	Char.Descr.	x_{61}	x_{62}	x_{63}	x_{64}	x_{65}	x_{66}	x_{67}	x_{68}	x_{69}	x_{70}
1024210	VM1698-4	53,20	52,88	53,15	53,07	53,03	53,04	52,89	53,04	52,95	53,00
1024210	VM1698-4	364,75	356,75	365,25	359,75	360,75	360,25	355,25	362,00	358,50	363,25

Char.No.	Char.Descr.	x_{71}	x_{72}	x_{73}	x_{74}	x_{75}	x_{76}	x_{77}	x_{78}	x_{79}	x_{80}
1024210	VM1698-4	53,30	52,95	53,03	53,12	53,08	53,03	53,22	52,92	53,00	53,01
1024210	VM1698-4	368,75	361,00	356,25	356,00	359,00	357,00	364,00	357,75	359,00	363,00

Machine Capability Study
Control System

Plant	ATG Westhausen		Operator Name	Sünder	Date 03.02.2022

Ser.No.	756029_a	Characteristic			
Type	1BD-1B060A-1K2D-1VK2D	Char.Descr.	VM1698-4	Inspection Val.	53,00
Ord. No.	1BD53T2O-A	Ser.No.	1024210	LSL	49,29
				USL	56,71
Remark	TQ 100% soft +/-7% * TQ-Cal.: 60.0 Nm; Cur-Cal.: 3.8391 Nm/A; Speed: 700/50 rpm;				

Char.No.	Char.Descr.	x_{81}	x_{82}	x_{83}	x_{84}	x_{85}	x_{86}	x_{87}	x_{88}	x_{89}	x_{90}
1024210	VM1698-4	52,96	53,24	52,99	52,97	52,87	53,03	53,31	53,26	53,05	52,98
1024210	VM1698-4	360,50	361,50	359,75	354,75	354,25	359,75	364,25	363,75	362,50	362,75

Char.No.	Char.Descr.	x_{91}	x_{92}	x_{93}	x_{94}	x_{95}	x_{96}	x_{97}	x_{98}	x_{99}	x_{100}
1024210	VM1698-4	53,08	53,26	53,03	52,91	52,99	53,06	52,99	53,33	53,10	53,16
1024210	VM1698-4	356,25	360,75	360,75	356,50	359,50	358,75	360,75	370,50	366,50	361,50

Machine Capability Study
Tool System

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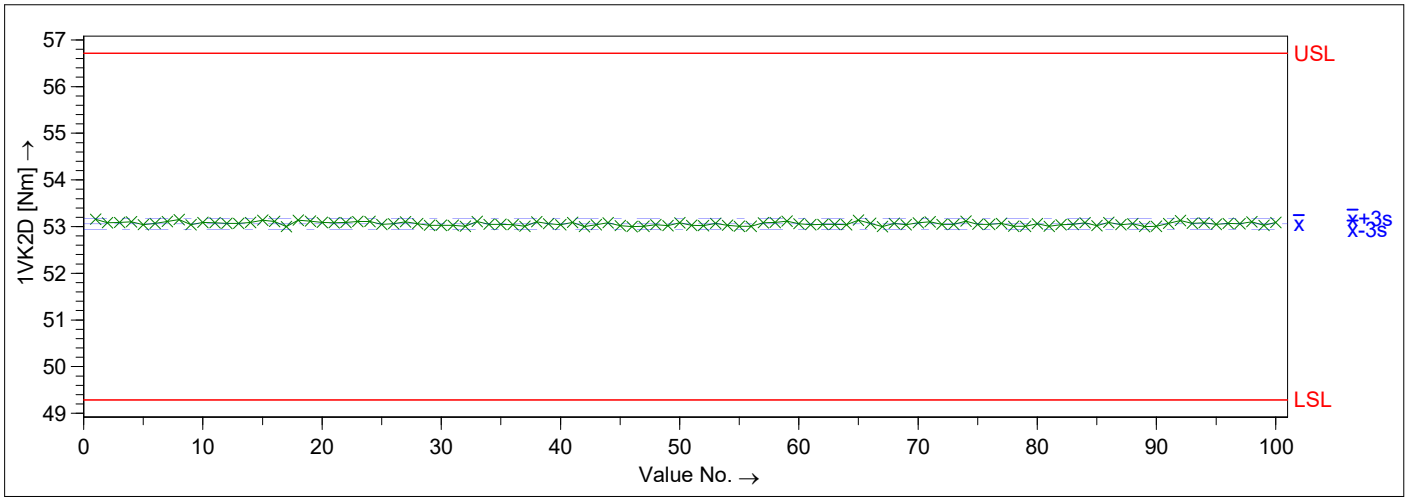
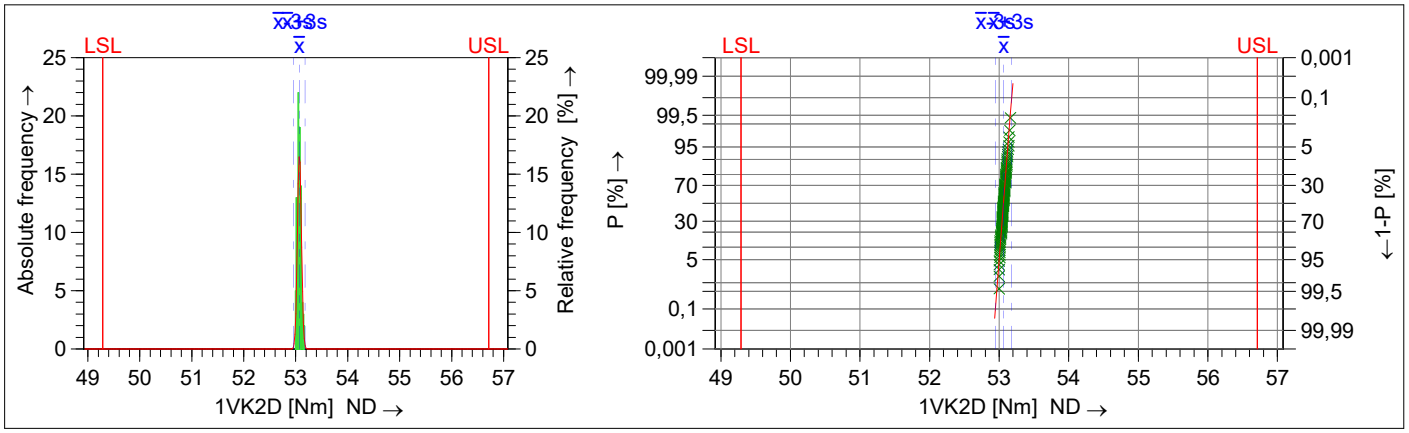
Plant ATG Westhausen		Operator Name Sünder	Date 03.02.2022

Ord. No. 1BD53T2O-A	Part type 1BD-1B060A-1K2D-1VK2D				Contr.item yes
Serial No. 756029_a	Char.Descr. 1VK2D	Inspection Val.	53,00	3,71	USL 56,71
	Serial No. 200694_1	Unit	Nm	-3,71	LSL 49,29
Char.Type variable		Tolerance value	7 %		Decimal Pl. 2
Cust.Name Cleco	Reference System VM1698-4	Test Electronic MPRO400GCD-P			
Contr.No. Homologation	Reference Transducer 50 / 1024729	nges. 100			

Evaluation from 03.02.2022 15:30:33 to 03.02.2022 17:20:02

Rem. TQ 100% soft +/-7% * TQ-Cal.: 60.0 Nm; Cur-Cal.: 3.8391 Nm/A; Speed: 700/50 rpm;





Drawing Values		Collected Values		Statistics	
T_m	53.00			$\bar{x}$	53.0626
LSL	49.29	x_{min}	53.00	$\bar{x}$-3s	52.9485
USL	56.71	x_{max}	53.16	$\bar{x}$+3s	53.1767
T	7.42	R	0.16	6s	0.2283
		$n_{<T>}$	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	32.50
Critical capability index	=	C_{mk}	31.95

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

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Machine Capability Study
Tool System

Plant	ATG Westhausen		Operator Name	Sünder	Date 03.02.2022

Ser.No.	756029_a	Characteristic			
Type	1BD-1B060A-1K2D-1VK2D	Char.Descr.	1VK2D	Inspection Val.	53,00
Ord. No.	1BD53T2O-A	Ser.No.	200694_1	LSL	49,29
				USL	56,71
Remark	TQ 100% soft +/-7% * TQ-Cal.: 60.0 Nm; Cur-Cal.: 3.8391 Nm/A; Speed: 700/50 rpm;				

Char.No.	Char.Descr.	x_1	x_2	x_3	x_4	x_5	x_6	x_7	x_8	x_9	x_{10}
200694_	1VK2D	53,16	53,08	53,09	53,10	53,04	53,07	53,11	53,15	53,04	53,09
200694_	1VK2D	358,00	378,00	362,00	360,00	374,00	378,00	378,00	382,00	356,00	377,00

Char.No.	Char.Descr.	x_{11}	x_{12}	x_{13}	x_{14}	x_{15}	x_{16}	x_{17}	x_{18}	x_{19}	x_{20}
200694_	1VK2D	53,08	53,07	53,07	53,09	53,14	53,11	53,00	53,14	53,12	53,09
200694_	1VK2D	366,00	371,00	372,00	370,00	362,00	372,00	360,00	353,00	365,00	366,00

Char.No.	Char.Descr.	x_{21}	x_{22}	x_{23}	x_{24}	x_{25}	x_{26}	x_{27}	x_{28}	x_{29}	x_{30}
200694_	1VK2D	53,08	53,09	53,11	53,11	53,05	53,06	53,10	53,06	53,03	53,03
200694_	1VK2D	361,00	366,00	351,00	369,00	364,00	367,00	364,00	360,00	352,00	365,00

Char.No.	Char.Descr.	x_{31}	x_{32}	x_{33}	x_{34}	x_{35}	x_{36}	x_{37}	x_{38}	x_{39}	x_{40}
200694_	1VK2D	53,03	53,01	53,11	53,05	53,05	53,04	53,01	53,10	53,06	53,04
200694_	1VK2D	362,00	356,00	350,00	368,00	364,00	365,00	362,00	364,00	358,00	358,00

Char.No.	Char.Descr.	x_{41}	x_{42}	x_{43}	x_{44}	x_{45}	x_{46}	x_{47}	x_{48}	x_{49}	x_{50}
200694_	1VK2D	53,09	53,00	53,04	53,08	53,02	53,00	53,01	53,04	53,02	53,08
200694_	1VK2D	361,00	357,00	364,00	368,00	365,00	360,00	360,00	360,00	359,00	364,00

Char.No.	Char.Descr.	x_{51}	x_{52}	x_{53}	x_{54}	x_{55}	x_{56}	x_{57}	x_{58}	x_{59}	x_{60}
200694_	1VK2D	53,03	53,02	53,07	53,03	53,01	53,01	53,08	53,09	53,12	53,06
200694_	1VK2D	367,00	364,00	356,00	362,00	359,00	359,00	358,00	357,00	361,00	360,00

Char.No.	Char.Descr.	x_{61}	x_{62}	x_{63}	x_{64}	x_{65}	x_{66}	x_{67}	x_{68}	x_{69}	x_{70}
200694_	1VK2D	53,04	53,05	53,05	53,04	53,14	53,07	53,00	53,07	53,04	53,08
200694_	1VK2D	363,00	358,00	366,00	360,00	361,00	360,00	356,00	362,00	359,00	363,00

Char.No.	Char.Descr.	x_{71}	x_{72}	x_{73}	x_{74}	x_{75}	x_{76}	x_{77}	x_{78}	x_{79}	x_{80}
200694_	1VK2D	53,10	53,05	53,05	53,12	53,05	53,05	53,07	53,01	53,01	53,06
200694_	1VK2D	367,00	362,00	356,00	357,00	360,00	357,00	363,00	358,00	359,00	363,00

Machine Capability Study
Tool System

Plant	ATG Westhausen		Operator Name	Sünder	Date 03.02.2022

Ser.No.	756029_a	Characteristic			
Type	1BD-1B060A-1K2D-1VK2D	Char.Descr.	1VK2D	Inspection Val.	53,00
Ord. No.	1BD53T2O-A	Ser.No.	200694_1	LSL	49,29
				USL	56,71
Remark	TQ 100% soft +/-7% * TQ-Cal.: 60.0 Nm; Cur-Cal.: 3.8391 Nm/A; Speed: 700/50 rpm;				

Char.No.	Char.Descr.	x_{81}	x_{82}	x_{83}	x_{84}	x_{85}	x_{86}	x_{87}	x_{88}	x_{89}	x_{90}
200694_	1VK2D	53,01	53,04	53,05	53,08	53,02	53,09	53,04	53,06	53,00	53,01
200694_	1VK2D	361,00	360,00	362,00	357,00	356,00	360,00	363,00	363,00	362,00	363,00

Char.No.	Char.Descr.	x_{91}	x_{92}	x_{93}	x_{94}	x_{95}	x_{96}	x_{97}	x_{98}	x_{99}	x_{100}
200694_	1VK2D	53,07	53,13	53,07	53,08	53,05	53,07	53,06	53,10	53,03	53,09
200694_	1VK2D	356,00	359,00	361,00	357,00	360,00	359,00	361,00	368,00	365,00	360,00

Machine Capability Study
Tool System

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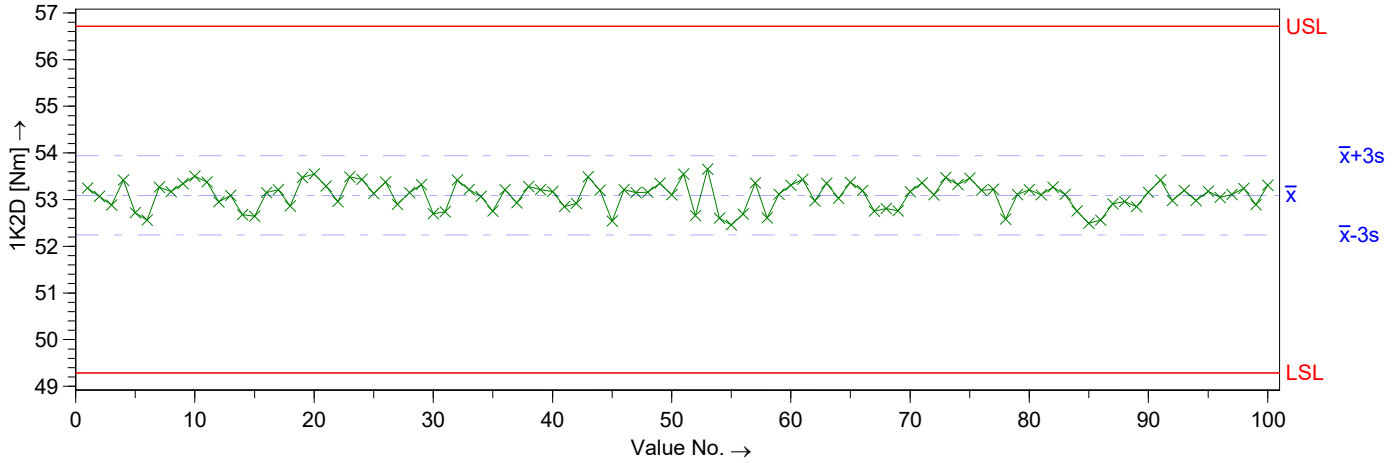
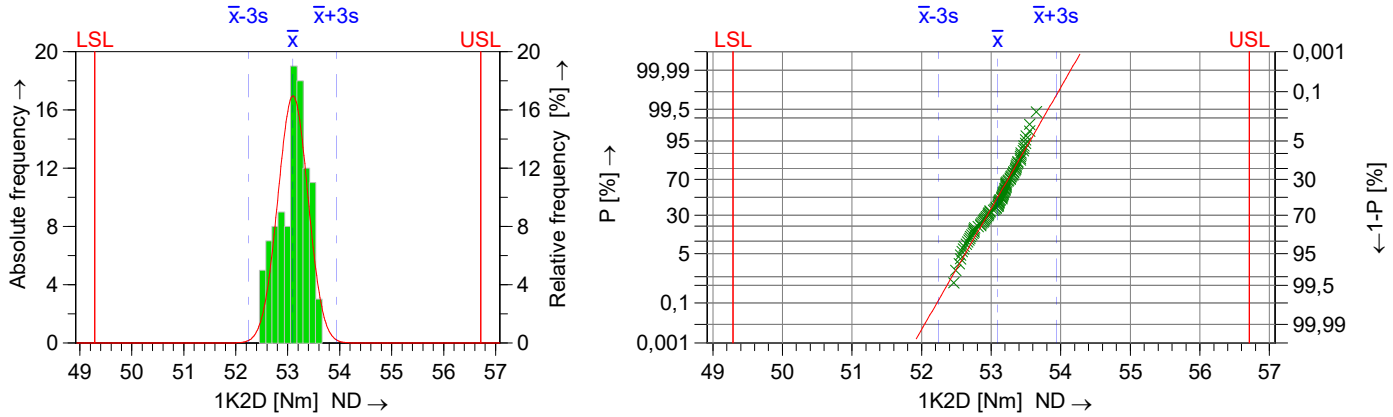
Plant ATG Westhausen		Operator Name Sünder	Date 03.02.2022

Ord. No. 1BD53T2O-A	Part type 1BD-1B060A-1K2D-1VK2D				Contr.item yes
Serial No. 756029_a	Char.Descr. 1K2D	Inspection Val.	53,00	3,71	USL 56,71
	Serial No. 202853	Unit	Nm	-3,71	LSL 49,29
Char.Type variable		Tolerance value	7 %		Decimal Pl. 2
Cust.Name Cleco	Reference System VM1698-4	Test Electronic MPRO400GCD-P			
Contr.No. Homologation	Reference Transducer 50 / 1024729	nges. 100			

Evaluation from 03.02.2022 15:30:33 to 03.02.2022 17:20:02

Rem. TQ 100% soft +/-7% * TQ-Cal.: 60.0 Nm; Cur-Cal.: 3.8391 Nm/A; Speed: 700/50 rpm;





Drawing Values		Collected Values		Statistics	
T_m	53.00			$\bar{x}$	53.0926
LSL	49.29	x_{min}	52.46	$\bar{x}$-3s	52.2464
USL	56.71	x_{max}	53.65	$\bar{x}$+3s	53.9388
T	7.42	R	1.19	6s	1.6925
		$n_{<T>}$	100	$p_{<T>}$	100.00000 %
		$n_{>USL}$	0	$p_{>USL}$	0.00000%
		$n_{<LSL}$	0	$p_{<LSL}$	0.00000%
		n_{eff}	100		
		n_{tot}	100		

Model distribution			Normal Distribution
Calculation method			$M1_{1.4}$ $\hat{\sigma} = s_{tot}$
Potential Capability index	=	C_m	4.38
Critical capability index	=	C_{mk}	4.27

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 03.02.2022

Ser.No.	756029_a	Characteristic			
Type	1BD-1B060A-1K2D-1VK2D	Char.Descr.	1K2D	Inspection Val.	53,00
Ord. No.	1BD53T2O-A	Ser.No.	202853	LSL	49,29
				USL	56,71
Remark	TQ 100% soft +/-7% * TQ-Cal.: 60.0 Nm; Cur-Cal.: 3.8391 Nm/A; Speed: 700/50 rpm;				

Char.No.	Char.Descr.	x_1	x_2	x_3	x_4	x_5	x_6	x_7	x_8	x_9	x_{10}
202853	1K2D	53,25	53,07	52,88	53,42	52,72	52,56	53,27	53,17	53,34	53,50
202853	1K2D	358,00	378,00	362,00	360,00	374,00	378,00	378,00	382,00	356,00	377,00

Char.No.	Char.Descr.	x_{11}	x_{12}	x_{13}	x_{14}	x_{15}	x_{16}	x_{17}	x_{18}	x_{19}	x_{20}
202853	1K2D	53,38	52,95	53,09	52,68	52,64	53,15	53,21	52,86	53,47	53,55
202853	1K2D	366,00	371,00	372,00	370,00	362,00	372,00	360,00	353,00	365,00	366,00

Char.No.	Char.Descr.	x_{21}	x_{22}	x_{23}	x_{24}	x_{25}	x_{26}	x_{27}	x_{28}	x_{29}	x_{30}
202853	1K2D	53,29	52,96	53,49	53,43	53,13	53,38	52,90	53,15	53,32	52,70
202853	1K2D	361,00	366,00	351,00	369,00	364,00	367,00	364,00	360,00	352,00	365,00

Char.No.	Char.Descr.	x_{31}	x_{32}	x_{33}	x_{34}	x_{35}	x_{36}	x_{37}	x_{38}	x_{39}	x_{40}
202853	1K2D	52,74	53,42	53,21	53,07	52,75	53,21	52,93	53,28	53,21	53,17
202853	1K2D	362,00	356,00	350,00	368,00	364,00	365,00	362,00	364,00	358,00	358,00

Char.No.	Char.Descr.	x_{41}	x_{42}	x_{43}	x_{44}	x_{45}	x_{46}	x_{47}	x_{48}	x_{49}	x_{50}
202853	1K2D	52,85	52,92	53,49	53,20	52,54	53,21	53,15	53,16	53,35	53,10
202853	1K2D	361,00	357,00	364,00	368,00	365,00	360,00	360,00	360,00	359,00	364,00

Char.No.	Char.Descr.	x_{51}	x_{52}	x_{53}	x_{54}	x_{55}	x_{56}	x_{57}	x_{58}	x_{59}	x_{60}
202853	1K2D	53,55	52,66	53,65	52,60	52,46	52,69	53,36	52,61	53,12	53,31
202853	1K2D	367,00	364,00	356,00	362,00	359,00	359,00	358,00	357,00	361,00	360,00

Char.No.	Char.Descr.	x_{61}	x_{62}	x_{63}	x_{64}	x_{65}	x_{66}	x_{67}	x_{68}	x_{69}	x_{70}
202853	1K2D	53,43	52,97	53,35	53,03	53,37	53,19	52,75	52,81	52,76	53,17
202853	1K2D	363,00	358,00	366,00	360,00	361,00	360,00	356,00	362,00	359,00	363,00

Char.No.	Char.Descr.	x_{71}	x_{72}	x_{73}	x_{74}	x_{75}	x_{76}	x_{77}	x_{78}	x_{79}	x_{80}
202853	1K2D	53,36	53,10	53,47	53,32	53,46	53,20	53,22	52,58	53,11	53,21
202853	1K2D	367,00	362,00	356,00	357,00	360,00	357,00	363,00	358,00	359,00	363,00

Machine Capability Study
Tool System

Plant	ATG Westhausen		Operator Name	Sünder	Date 03.02.2022

Ser.No.	756029_a	Characteristic			
Type	1BD-1B060A-1K2D-1VK2D	Char.Descr.	1K2D	Inspection Val.	53,00
Ord. No.	1BD53T2O-A	Ser.No.	202853	LSL	49,29
				USL	56,71
Remark	TQ 100% soft +/-7% * TQ-Cal.: 60.0 Nm; Cur-Cal.: 3.8391 Nm/A; Speed: 700/50 rpm;				

Char.No.	Char.Descr.	x_{81}	x_{82}	x_{83}	x_{84}	x_{85}	x_{86}	x_{87}	x_{88}	x_{89}	x_{90}
202853	1K2D	53,10	53,27	53,11	52,75	52,49	52,56	52,91	52,96	52,85	53,16
202853	1K2D	361,00	360,00	362,00	357,00	356,00	360,00	363,00	363,00	362,00	363,00

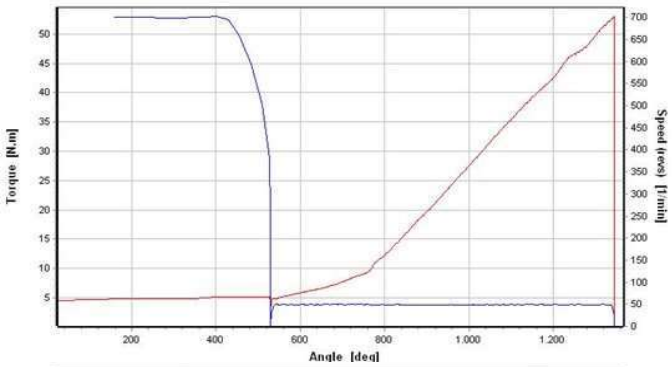
Char.No.	Char.Descr.	x_{91}	x_{92}	x_{93}	x_{94}	x_{95}	x_{96}	x_{97}	x_{98}	x_{99}	x_{100}
202853	1K2D	53,42	52,98	53,20	52,98	53,18	53,05	53,11	53,24	52,89	53,31
202853	1K2D	356,00	359,00	361,00	357,00	360,00	359,00	361,00	368,00	365,00	360,00

Torque graphs

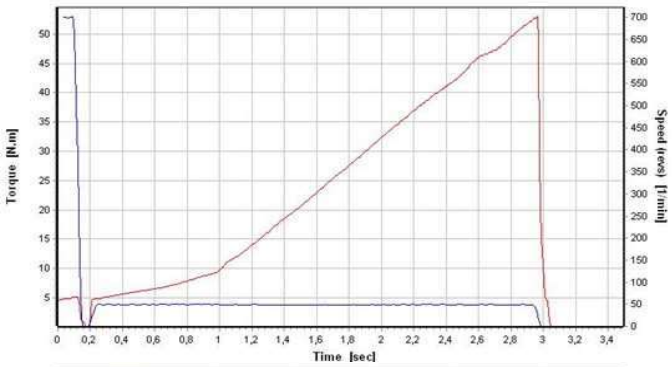
Machine Capability Study 100 %

Model: **1BD-1B060A-1K2D-1VK2D**
Serial no: **756029**

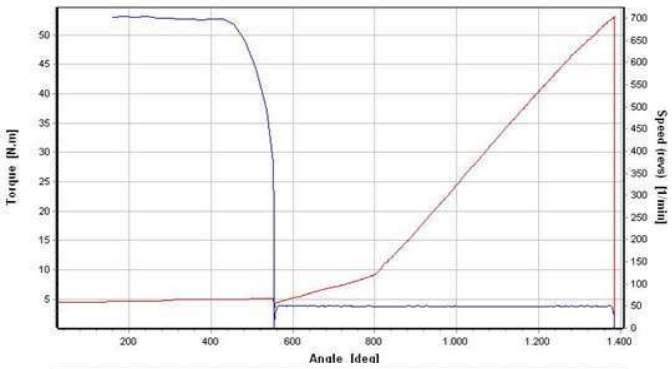
Angle degree: **360°**
Test torque: **53,0 Nm**



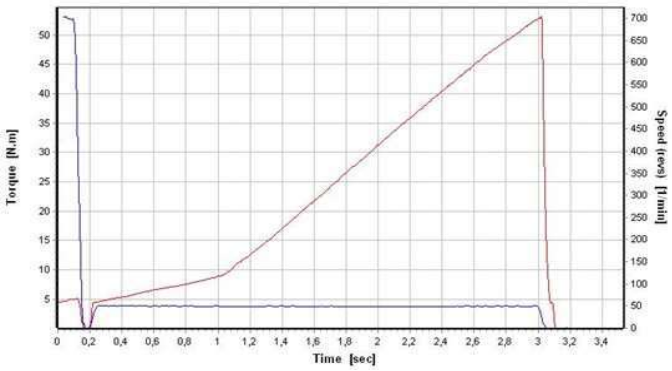
Value no. 1
Graph
Torque / Angle / Speed



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: 1BD-1B060A-1K2D-1VK2D **Serial no:** 756029

Torque range: **5,3 Nm to 53 Nm**

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

Capability examination

Snugfit value: 10,6 Nm **Torque tolerance ±** 7 %

Target torque: 31,8 Nm Tolerance: 1,72 % ± **0,86 %**

Angle degree: 40° Tolerance: 4,7° ± **2,3°**

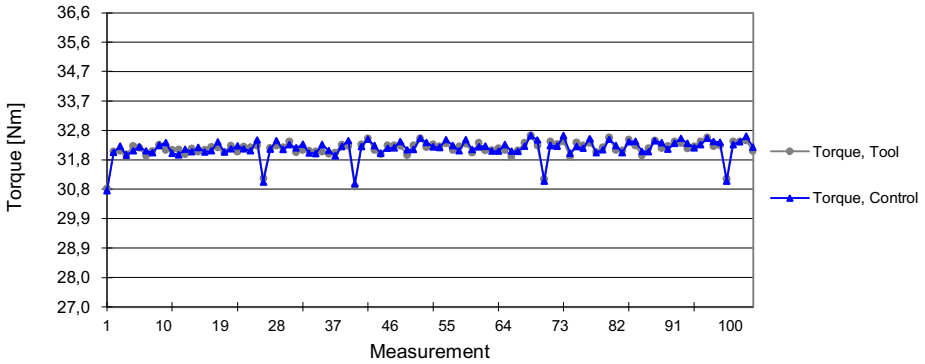
Formula derivation: $C_m = \frac{T}{6\,s}$ $T = C_m * 6\,s$

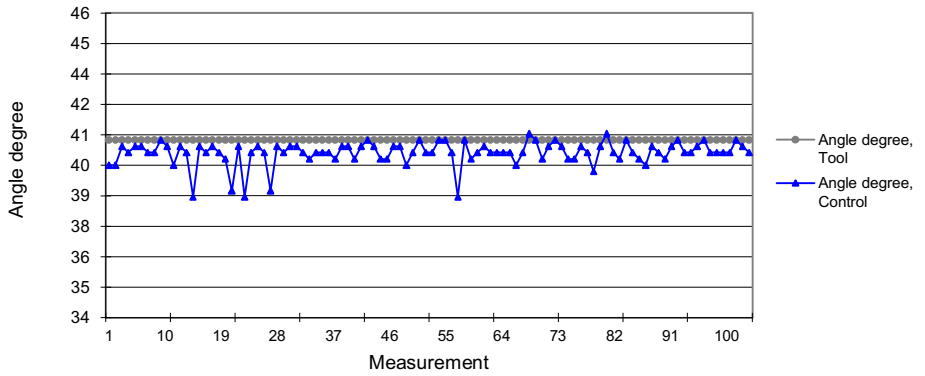
Tool without angle correction

Measurement	Tool data		Control data		Difference	
No.	Torque	Angle	Torque	Angle	Torque	Angle
1	30,86	41,00	30,80	40,00	0,06	1,00
2	32,07	41,00	32,04	40,00	0,03	1,00
3	32,09	41,00	32,24	40,75	0,15	0,25
4	31,97	41,00	31,95	40,50	0,02	0,50
5	32,24	41,00	32,09	40,75	0,15	0,25
6	32,19	41,00	32,22	40,75	0,03	0,25
7	31,93	41,00	32,09	40,50	0,16	0,50
8	32,08	41,00	32,03	40,50	0,05	0,50
9	32,28	41,00	32,27	41,00	0,01	0,00
10	32,11	41,00	32,35	40,75	0,24	0,25
11	32,12	41,00	32,01	40,00	0,11	1,00
12	32,13	41,00	31,96	40,75	0,17	0,25
13	31,98	41,00	32,14	40,50	0,16	0,50
14	32,16	41,00	32,06	38,75	0,10	2,25
15	32,06	41,00	32,20	40,75	0,14	0,25
16	32,12	41,00	32,05	40,50	0,07	0,50
17	32,21	41,00	32,09	40,75	0,12	0,25
18	32,20	41,00	32,38	40,50	0,18	0,50
19	32,05	41,00	32,05	40,25	0,00	0,75
20	32,25	41,00	32,15	39,00	0,10	2,00
21	32,06	41,00	32,25	40,75	0,19	0,25
22	32,22	41,00	32,15	38,75	0,07	2,25
23	32,20	41,00	32,09	40,50	0,11	0,50
24	32,27	41,00	32,44	40,75	0,17	0,25
25	31,19	41,00	31,08	40,50	0,11	0,50
26	32,18	41,00	32,14	39,00	0,04	2,00
27	32,26	41,00	32,42	40,75	0,16	0,25
28	32,20	41,00	32,13	40,50	0,07	0,50
29	32,40	41,00	32,29	40,75	0,11	0,25
30	32,04	41,00	32,19	40,75	0,15	0,25
31	32,11	41,00	32,30	40,50	0,19	0,50
32	32,09	41,00	32,02	40,25	0,07	0,75
33	32,07	41,00	32,00	40,50	0,07	0,50
34	32,06	41,00	32,29	40,50	0,23	0,50
35	31,99	41,00	32,10	40,50	0,11	0,50
36	32,03	41,00	31,93	40,25	0,10	0,75
37	32,28	41,00	32,23	40,75	0,05	0,25
38	32,25	41,00	32,42	40,75	0,17	0,25
39	30,93	41,00	31,02	40,25	0,09	0,75
40	32,29	41,00	32,23	40,75	0,06	0,25
41	32,50	41,00	32,47	41,00	0,03	0,00
42	32,11	41,00	32,26	40,75	0,15	0,25
43	31,98	41,00	32,01	40,25	0,03	0,75
44	32,27	41,00	32,17	40,25	0,10	0,75
45	32,26	41,00	32,19	40,75	0,07	0,25
46	32,25	41,00	32,39	40,75	0,14	0,25
47	31,95	41,00	32,12	40,00	0,17	1,00
48	32,26	41,00	32,13	40,50	0,13	0,50
49	32,50	41,00	32,49	41,00	0,01	0,00
50	32,21	41,00	32,36	40,50	0,15	0,50
51	32,29	41,00	32,22	40,50	0,07	0,50
52	32,23	41,00	32,20	41,00	0,03	0,00
53	32,33	41,00	32,45	41,00	0,12	0,00
54	32,11	41,00	32,26	40,50	0,15	0,50
55	32,23	41,00	32,09	38,75	0,14	2,25
56	32,32	41,00	32,45	41,00	0,13	0,00
57	32,03	41,00	32,13	40,25	0,10	0,75
58	32,34	41,00	32,22	40,50	0,12	0,50
59	32,10	41,00	32,24	40,75	0,14	0,25
60	32,11	41,00	32,08	40,50	0,03	0,50
61	32,17	41,00	32,08	40,50	0,09	0,50
62	32,11	41,00	32,29	40,50	0,18	0,50
63	31,90	41,00	32,08	40,50	0,18	0,50
64	32,10	41,00	32,07	40,00	0,03	1,00
65	32,34	41,00	32,24	40,50	0,10	0,50
66	32,59	41,00	32,58	41,25	0,01	0,25
67	32,26	41,00	32,44	41,00	0,18	0,00
68	31,17	41,00	31,11	40,25	0,06	0,75
69	32,39	41,00	32,27	40,75	0,12	0,25
70	32,30	41,00	32,24	41,00	0,06	0,00
71	32,40	41,00	32,58	40,75	0,18	0,25
72	31,90	41,00	32,01	40,25	0,11	0,75
73	32,36	41,00	32,23	40,25	0,13	0,75
74	32,27	41,00	32,17	40,75	0,10	0,25
75	32,34	41,00	32,48	40,50	0,14	0,50
76	32,05	41,00	32,03	39,75	0,02	1,25
77	32,20	41,00	32,12	40,75	0,08	0,25
78	32,52	41,00	32,47	41,25	0,05	0,25
79	32,11	41,00	32,26	40,50	0,15	0,50
80	32,10	41,00	32,03	40,25	0,07	0,75
81	32,46	41,00	32,38	41,00	0,08	0,00
82	32,26	41,00	32,40	40,50	0,14	0,50
83	31,94	41,00	32,07	40,25	0,13	0,75
84	32,17	41,00	32,06	40,00	0,11	1,00
85	32,43	41,00	32,41	40,75	0,02	0,25
86	32,18	41,00	32,35	40,50	0,17	0,50
87	32,24	41,00	32,14	40,25	0,10	0,75
88	32,40	41,00	32,33	40,75	0,07	0,25
89	32,34	41,00	32,49	41,00	0,15	0,00
90	32,16	41,00	32,33	40,50	0,17	0,50
91	32,23	41,00	32,19	40,50	0,04	0,50
92	32,39	41,00	32,29	40,75	0,10	0,25
93	32,53	41,00	32,49	41,00	0,04	0,00
94	32,24	41,00	32,39	40,50	0,15	0,50
95	32,27	41,00	32,37	40,50	0,10	0,50
96	31,18	41,00	31,11	40,50	0,07	0,50
97	32,40	41,00	32,29	40,50	0,11	0,50
98	32,39	41,00	32,38	41,00	0,01	0,00
99	32,42	41,00	32,57	40,75	0,15	0,25
100	32,08	41,00	32,21	40,50	0,13	0,50
				Standard deviation:	**0,055**	**0,464**

Graphical representation

Model:	**1BD-1B060A-1K2D-1VK2D**	Serial no:	**756029**
Target torque:	**31,80 Nm**	60 % of max. torque	
Angle degree:	**40°**	Tool without angle correction	





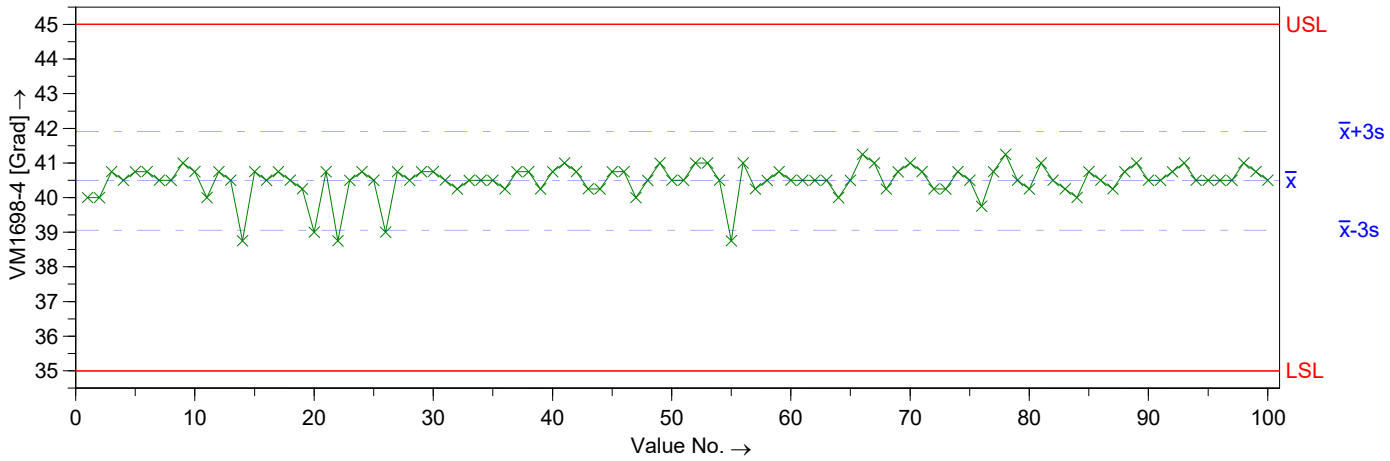
Machine Capability Study
Control System

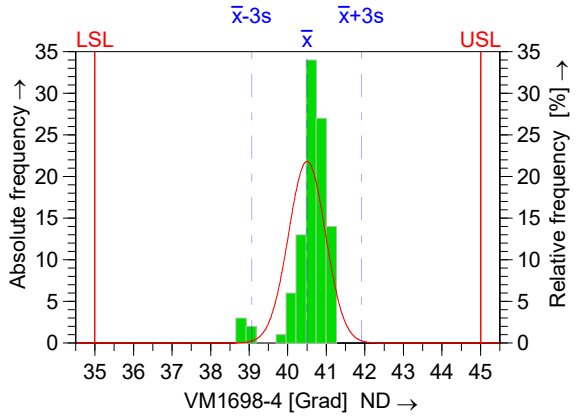
Plant	ATG Westhausen	Operator Name	Sünder
Date	03.02.2022		

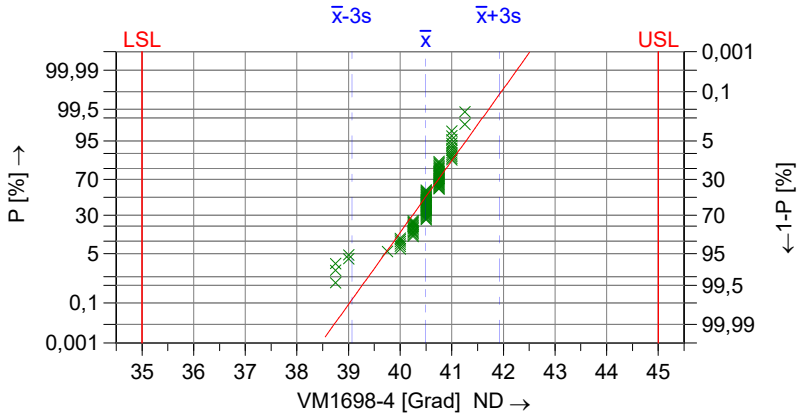
Ord. No.	1BD53T2O-A	Part type	1BD-1B060A-1K2D-1VK2D	Contr.item	yes
Serial No.	756029_k	Char.Descr.	VM1698-4	Inspection Val. 40,00 5,00	USL 45,00
		Serial No.	1024210	Unit Grad -5,00	LSL 35,00
Char.Type	variable			Tolerance value 12 %	Decimal Pl. 2
Cust.Name	Cleco	Reference System	VM1698-4	Test Electronic	MPRO400GCD-P
Contr.No.	Homologation	Reference Transducer	50 / 1024729	nges.	100

Evaluation from 03.02.2022 14:54:37 to 03.02.2022 15:08:48

Rem. TQ 60% Angle 40° +/-5° * TQ-Cal.: 60.0 Nm; Cur-Cal.: 3.8391 Nm/A; Speed: 300/50 rpm;







Drawing Values		Collected Values		Statistics	
T_m	40.00			$\bar{x}$	40.4900
LSL	35.00	x_{min}	38.75	$\bar{x}$-3s	39.0641
USL	45.00	x_{max}	41.25	$\bar{x}$+3s	41.9159
T	10.00	R	2.50	6s	2.8518
		$n_{<T>}$	100	$p_{<T>}$	100.00000 %
		$n_{>USL}$	0	$p_{>USL}$	0.00000%
		$n_{<LSL}$	0	$p_{<LSL}$	0.00000%
		n_{eff}	100		
		n_{tot}	100		

Model distribution			Normal Distribution
Calculation method			M1 1.4 $\hat{\sigma} = s_{tot}$
Potential Capability index	=	C_m	3.51
Critical capability index	=	C_{mk}	3.16

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 03.02.2022

Ser.No.	756029_k	Characteristic			
Type	1BD-1B060A-1K2D-1VK2D	Char.Descr.	VM1698-4	Inspection Val.	31,80
Ord. No.	1BD53T2O-A	Ser.No.	1024210	LSL	29,57
				USL	34,03
Remark	TQ 60% Angle 40°+/-5°* TQ-Cal.: 60.0 Nm; Cu r-Cal.: 3.8391 Nm/A; Speed: 300/50 rpm;				

Char.No.	Char.Descr.	x_1	x_2	x_3	x_4	x_5	x_6	x_7	x_8	x_9	x_{10}
1024210	VM1698-4	30,80	32,04	32,24	31,95	32,09	32,22	32,09	32,03	32,27	32,35
1024210	VM1698-4	40,00	40,00	40,75	40,50	40,75	40,75	40,50	40,50	41,00	40,75

Char.No.	Char.Descr.	x_{11}	x_{12}	x_{13}	x_{14}	x_{15}	x_{16}	x_{17}	x_{18}	x_{19}	x_{20}
1024210	VM1698-4	32,01	31,96	32,14	32,06	32,20	32,05	32,09	32,38	32,05	32,15
1024210	VM1698-4	40,00	40,75	40,50	38,75	40,75	40,50	40,75	40,50	40,25	39,00

Char.No.	Char.Descr.	x_{21}	x_{22}	x_{23}	x_{24}	x_{25}	x_{26}	x_{27}	x_{28}	x_{29}	x_{30}
1024210	VM1698-4	32,25	32,15	32,09	32,44	31,08	32,14	32,42	32,13	32,29	32,19
1024210	VM1698-4	40,75	38,75	40,50	40,75	40,50	39,00	40,75	40,50	40,75	40,75

Char.No.	Char.Descr.	x_{31}	x_{32}	x_{33}	x_{34}	x_{35}	x_{36}	x_{37}	x_{38}	x_{39}	x_{40}
1024210	VM1698-4	32,30	32,02	32,00	32,29	32,10	31,93	32,23	32,42	31,02	32,23
1024210	VM1698-4	40,50	40,25	40,50	40,50	40,50	40,25	40,75	40,75	40,25	40,75

Char.No.	Char.Descr.	x_{41}	x_{42}	x_{43}	x_{44}	x_{45}	x_{46}	x_{47}	x_{48}	x_{49}	x_{50}
1024210	VM1698-4	32,47	32,26	32,01	32,17	32,19	32,39	32,12	32,13	32,49	32,36
1024210	VM1698-4	41,00	40,75	40,25	40,25	40,75	40,75	40,00	40,50	41,00	40,50

Char.No.	Char.Descr.	x_{51}	x_{52}	x_{53}	x_{54}	x_{55}	x_{56}	x_{57}	x_{58}	x_{59}	x_{60}
1024210	VM1698-4	32,22	32,20	32,45	32,26	32,09	32,45	32,13	32,22	32,24	32,08
1024210	VM1698-4	40,50	41,00	41,00	40,50	38,75	41,00	40,25	40,50	40,75	40,50

Char.No.	Char.Descr.	x_{61}	x_{62}	x_{63}	x_{64}	x_{65}	x_{66}	x_{67}	x_{68}	x_{69}	x_{70}
1024210	VM1698-4	32,08	32,29	32,08	32,07	32,24	32,58	32,44	31,11	32,27	32,24
1024210	VM1698-4	40,50	40,50	40,50	40,00	40,50	41,25	41,00	40,25	40,75	41,00

Char.No.	Char.Descr.	x_{71}	x_{72}	x_{73}	x_{74}	x_{75}	x_{76}	x_{77}	x_{78}	x_{79}	x_{80}
1024210	VM1698-4	32,58	32,01	32,23	32,17	32,48	32,03	32,12	32,47	32,26	32,03
1024210	VM1698-4	40,75	40,25	40,25	40,75	40,50	39,75	40,75	41,25	40,50	40,25

Machine Capability Study
Control System

Plant	ATG Westhausen		Operator Name	Sünder	Date 03.02.2022

Ser.No.	756029_k	Characteristic			
Type	1BD-1B060A-1K2D-1VK2D	Char.Descr.	VM1698-4	Inspection Val.	31,80
Ord. No.	1BD53T2O-A	Ser.No.	1024210	LSL	29,57
				USL	34,03
Remark	TQ 60% Angle 40°+/-5°* TQ-Cal.: 60.0 Nm; Cu r-Cal.: 3.8391 Nm/A; Speed: 300/50 rpm;				

Char.No.	Char.Descr.	x_{81}	x_{82}	x_{83}	x_{84}	x_{85}	x_{86}	x_{87}	x_{88}	x_{89}	x_{90}
1024210	VM1698-4	32,38	32,40	32,07	32,06	32,41	32,35	32,14	32,33	32,49	32,33
1024210	VM1698-4	41,00	40,50	40,25	40,00	40,75	40,50	40,25	40,75	41,00	40,50

Char.No.	Char.Descr.	x_{91}	x_{92}	x_{93}	x_{94}	x_{95}	x_{96}	x_{97}	x_{98}	x_{99}	x_{100}
1024210	VM1698-4	32,19	32,29	32,49	32,39	32,37	31,11	32,29	32,38	32,57	32,21
1024210	VM1698-4	40,50	40,75	41,00	40,50	40,50	40,50	40,50	41,00	40,75	40,50

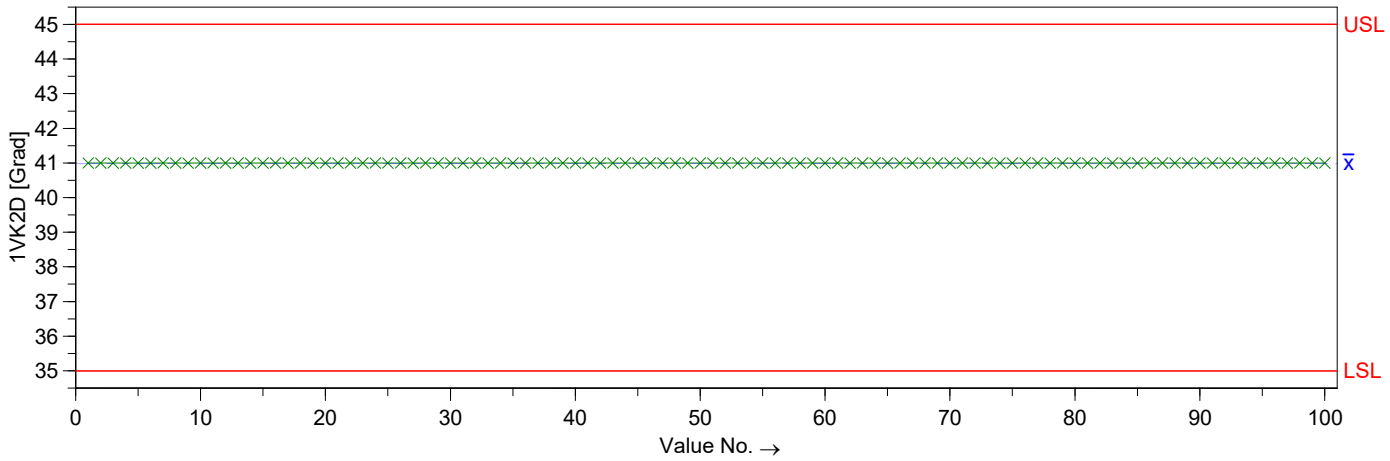
Machine Capability Study
Tool System

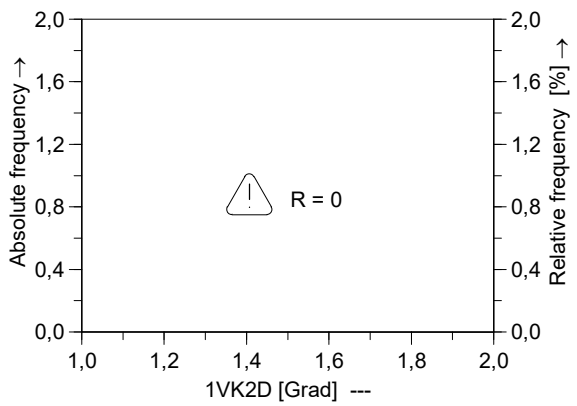
Plant	ATG Westhausen	Operator Name	Sünder
Date	03.02.2022		

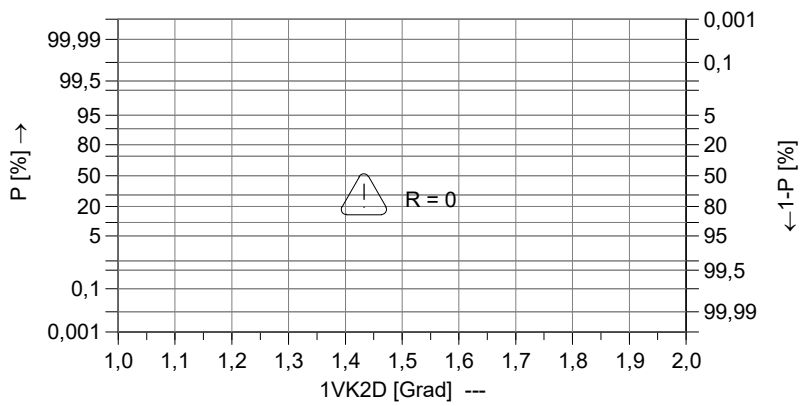
Ord. No.	1BD53T2O-A	Part type	1BD-1B060A-1K2D-1VK2D	Contr.item	yes
Serial No.	756029_k	Char.Descr.	1VK2D	Inspection Val. 40,00 5,00	USL 45,00
		Serial No.	200694_1	Unit Grad -5,00	LSL 35,00
Char.Type	variable			Tolerance value 12 %	Decimal Pl. 2
Cust.Name	Cleco	Reference System	VM1698-4	Test Electronic	MPRO400GCD-P
Contr.No.	Homologation	Reference Transducer	50 / 1024729	nges.	100

Evaluation from 03.02.2022 14:54:38 to 03.02.2022 15:08:48

Rem. TQ 60% Angle 40° +/-5° * TQ-Cal.: 60.0 Nm; Cur-Cal.: 3.8391 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 03.02.2022

Ser.No.	756029_k	Characteristic			
Type	1BD-1B060A-1K2D-1VK2D	Char.Descr.	1VK2D	Inspection Val.	31,80
Ord. No.	1BD53T2O-A	Ser.No.	200694_1	LSL	29,57
				USL	34,03
Remark	TQ 60% Angle 40°+/-5°* TQ-Cal.: 60.0 Nm; Cu r-Cal.: 3.8391 Nm/A; Speed: 300/50 rpm;				

Char.No.	Char.Descr.	x_1	x_2	x_3	x_4	x_5	x_6	x_7	x_8	x_9	x_{10}
200694_	1VK2D	30,86	32,07	32,09	31,97	32,24	32,19	31,93	32,08	32,28	32,11
200694_	1VK2D	41,00	41,00	41,00	41,00	41,00	41,00	41,00	41,00	41,00	41,00

Char.No.	Char.Descr.	x_{11}	x_{12}	x_{13}	x_{14}	x_{15}	x_{16}	x_{17}	x_{18}	x_{19}	x_{20}
200694_	1VK2D	32,12	32,13	31,98	32,16	32,06	32,12	32,21	32,20	32,05	32,25
200694_	1VK2D	41,00	41,00	41,00	41,00	41,00	41,00	41,00	41,00	41,00	41,00

Char.No.	Char.Descr.	x_{21}	x_{22}	x_{23}	x_{24}	x_{25}	x_{26}	x_{27}	x_{28}	x_{29}	x_{30}
200694_	1VK2D	32,06	32,22	32,20	32,27	31,19	32,18	32,26	32,20	32,40	32,04
200694_	1VK2D	41,00	41,00	41,00	41,00	41,00	41,00	41,00	41,00	41,00	41,00

Char.No.	Char.Descr.	x_{31}	x_{32}	x_{33}	x_{34}	x_{35}	x_{36}	x_{37}	x_{38}	x_{39}	x_{40}
200694_	1VK2D	32,11	32,09	32,07	32,06	31,99	32,03	32,28	32,25	30,93	32,29
200694_	1VK2D	41,00	41,00	41,00	41,00	41,00	41,00	41,00	41,00	41,00	41,00

Char.No.	Char.Descr.	x_{41}	x_{42}	x_{43}	x_{44}	x_{45}	x_{46}	x_{47}	x_{48}	x_{49}	x_{50}
200694_	1VK2D	32,50	32,11	31,98	32,27	32,26	32,25	31,95	32,26	32,50	32,21
200694_	1VK2D	41,00	41,00	41,00	41,00	41,00	41,00	41,00	41,00	41,00	41,00

Char.No.	Char.Descr.	x_{51}	x_{52}	x_{53}	x_{54}	x_{55}	x_{56}	x_{57}	x_{58}	x_{59}	x_{60}
200694_	1VK2D	32,29	32,23	32,33	32,11	32,23	32,32	32,03	32,34	32,10	32,11
200694_	1VK2D	41,00	41,00	41,00	41,00	41,00	41,00	41,00	41,00	41,00	41,00

Char.No.	Char.Descr.	x_{61}	x_{62}	x_{63}	x_{64}	x_{65}	x_{66}	x_{67}	x_{68}	x_{69}	x_{70}
200694_	1VK2D	32,17	32,11	31,90	32,10	32,34	32,59	32,26	31,17	32,39	32,30
200694_	1VK2D	41,00	41,00	41,00	41,00	41,00	41,00	41,00	41,00	41,00	41,00

Char.No.	Char.Descr.	x_{71}	x_{72}	x_{73}	x_{74}	x_{75}	x_{76}	x_{77}	x_{78}	x_{79}	x_{80}
200694_	1VK2D	32,40	31,90	32,36	32,27	32,34	32,05	32,20	32,52	32,11	32,10
200694_	1VK2D	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 03.02.2022

Ser.No.	756029_k	Characteristic			
Type	1BD-1B060A-1K2D-1VK2D	Char.Descr.	1VK2D	Inspection Val.	31,80
Ord. No.	1BD53T2O-A	Ser.No.	200694_1	LSL	29,57
				USL	34,03
Remark	TQ 60% Angle 40°+/-5°* TQ-Cal.: 60.0 Nm; Cu r-Cal.: 3.8391 Nm/A; Speed: 300/50 rpm;				

Char.No.	Char.Descr.	x_{81}	x_{82}	x_{83}	x_{84}	x_{85}	x_{86}	x_{87}	x_{88}	x_{89}	x_{90}
200694_	1VK2D	32,46	32,26	31,94	32,17	32,43	32,18	32,24	32,40	32,34	32,16
200694_	1VK2D	41,00	41,00	41,00	41,00	41,00	41,00	41,00	41,00	41,00	41,00

Char.No.	Char.Descr.	x_{91}	x_{92}	x_{93}	x_{94}	x_{95}	x_{96}	x_{97}	x_{98}	x_{99}	x_{100}
200694_	1VK2D	32,23	32,39	32,53	32,24	32,27	31,18	32,40	32,39	32,42	32,08
200694_	1VK2D	41,00	41,00	41,00	41,00	41,00	41,00	41,00	41,00	41,00	41,00

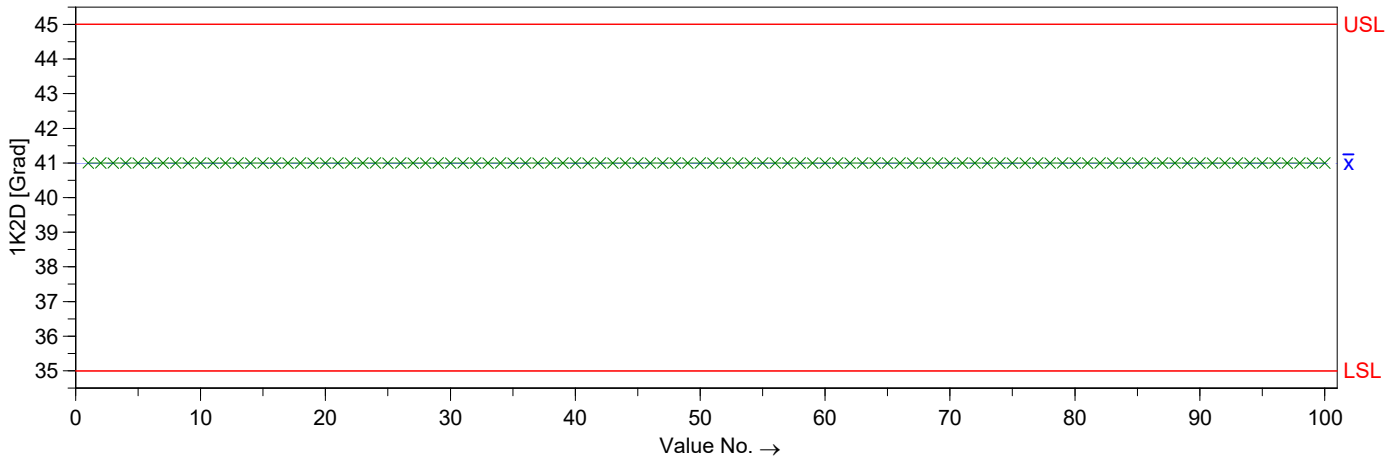
Machine Capability Study
Tool System

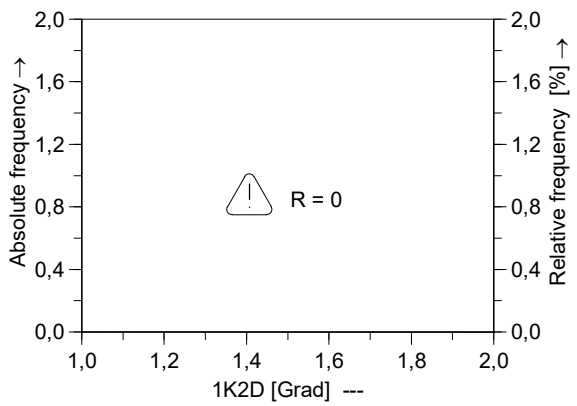
Plant	ATG Westhausen	Operator Name	Sünder
Date	03.02.2022		

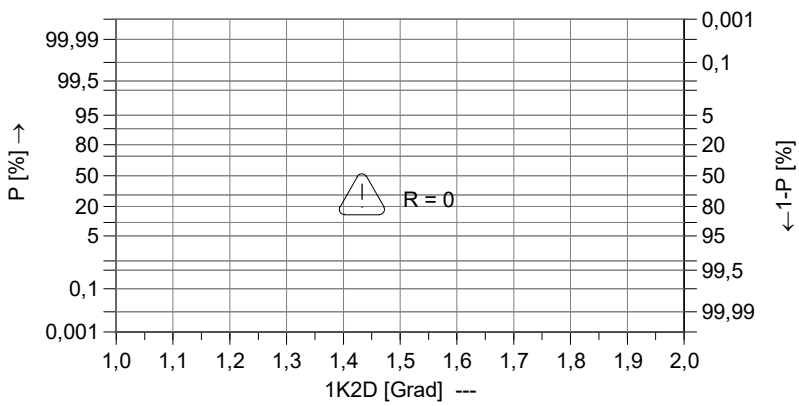
Ord. No.	1BD53T2O-A	Part type	1BD-1B060A-1K2D-1VK2D	Contr.item	yes
Serial No.	756029_k	Char.Descr.	1K2D	Inspection Val. 40,00 5,00	USL 45,00
		Serial No.	202853	Unit Grad -5,00	LSL 35,00
Char.Type	variable			Tolerance value 12 %	Decimal Pl. 2
Cust.Name	Cleco	Reference System	VM1698-4	Test Electronic	MPRO400GCD-P
Contr.No.	Homologation	Reference Transducer	50 / 1024729	nges.	100

Evaluation from 03.02.2022 14:54:38 to 03.02.2022 15:08:48

Rem. TQ 60% Angle 40° +/-5° * TQ-Cal.: 60.0 Nm; Cur-Cal.: 3.8391 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 03.02.2022

Ser.No.	756029_k	Characteristic			
Type	1BD-1B060A-1K2D-1VK2D	Char.Descr.	1K2D	Inspection Val.	31,80
Ord. No.	1BD53T2O-A	Ser.No.	202853	LSL	29,57
				USL	34,03
Remark	TQ 60% Angle 40°+/-5°* TQ-Cal.: 60.0 Nm; Cu r-Cal.: 3.8391 Nm/A; Speed: 300/50 rpm;				

Char.No.	Char.Descr.	x_1	x_2	x_3	x_4	x_5	x_6	x_7	x_8	x_9	x_{10}
202853	1K2D	30,50	32,15	32,05	31,59	32,16	32,25	31,70	31,69	32,39	32,54
202853	1K2D	41,00	41,00	41,00	41,00	41,00	41,00	41,00	41,00	41,00	41,00

Char.No.	Char.Descr.	x_{11}	x_{12}	x_{13}	x_{14}	x_{15}	x_{16}	x_{17}	x_{18}	x_{19}	x_{20}
202853	1K2D	32,33	31,71	32,46	32,26	31,91	32,05	31,99	31,98	31,86	32,38
202853	1K2D	41,00	41,00	41,00	41,00	41,00	41,00	41,00	41,00	41,00	41,00

Char.No.	Char.Descr.	x_{21}	x_{22}	x_{23}	x_{24}	x_{25}	x_{26}	x_{27}	x_{28}	x_{29}	x_{30}
202853	1K2D	32,31	32,30	32,15	32,60	31,39	32,21	32,64	32,41	32,12	31,99
202853	1K2D	41,00	41,00	41,00	41,00	41,00	41,00	41,00	41,00	41,00	41,00

Char.No.	Char.Descr.	x_{31}	x_{32}	x_{33}	x_{34}	x_{35}	x_{36}	x_{37}	x_{38}	x_{39}	x_{40}
202853	1K2D	32,32	32,16	31,78	32,14	31,73	31,69	32,30	32,47	31,11	32,00
202853	1K2D	41,00	41,00	41,00	41,00	41,00	41,00	41,00	41,00	41,00	41,00

Char.No.	Char.Descr.	x_{41}	x_{42}	x_{43}	x_{44}	x_{45}	x_{46}	x_{47}	x_{48}	x_{49}	x_{50}
202853	1K2D	32,14	32,26	31,70	32,35	32,40	32,16	32,22	31,85	32,44	32,05
202853	1K2D	41,00	41,00	41,00	41,00	41,00	41,00	41,00	41,00	41,00	41,00

Char.No.	Char.Descr.	x_{51}	x_{52}	x_{53}	x_{54}	x_{55}	x_{56}	x_{57}	x_{58}	x_{59}	x_{60}
202853	1K2D	31,91	32,21	32,64	32,17	31,90	32,49	31,90	32,07	32,24	32,33
202853	1K2D	41,00	41,00	41,00	41,00	41,00	41,00	41,00	41,00	41,00	41,00

Char.No.	Char.Descr.	x_{61}	x_{62}	x_{63}	x_{64}	x_{65}	x_{66}	x_{67}	x_{68}	x_{69}	x_{70}
202853	1K2D	31,83	32,27	31,76	32,01	32,31	32,28	32,59	31,12	31,91	32,44
202853	1K2D	41,00	41,00	41,00	41,00	41,00	41,00	41,00	41,00	41,00	41,00

Char.No.	Char.Descr.	x_{71}	x_{72}	x_{73}	x_{74}	x_{75}	x_{76}	x_{77}	x_{78}	x_{79}	x_{80}
202853	1K2D	32,31	32,23	32,39	31,84	32,63	31,93	31,85	32,39	32,14	32,00
202853	1K2D	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 03.02.2022

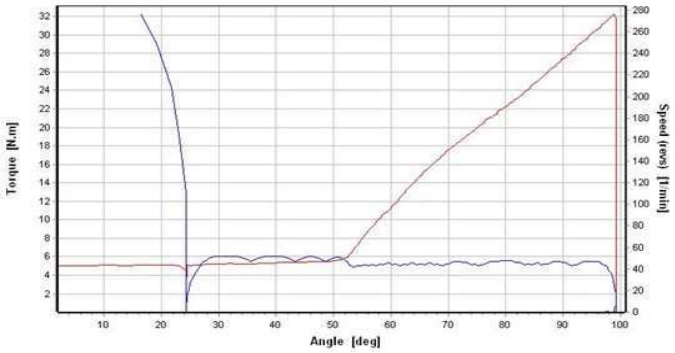
Ser.No.	756029_k	Characteristic			
Type	1BD-1B060A-1K2D-1VK2D	Char.Descr.	1K2D	Inspection Val.	31,80
Ord. No.	1BD53T2O-A	Ser.No.	202853	LSL	29,57
				USL	34,03
Remark	TQ 60% Angle 40°+/-5°* TQ-Cal.: 60.0 Nm; Cu r-Cal.: 3.8391 Nm/A; Speed: 300/50 rpm;				

Char.No.	Char.Descr.	x_{81}	x_{82}	x_{83}	x_{84}	x_{85}	x_{86}	x_{87}	x_{88}	x_{89}	x_{90}
202853	1K2D	32,39	32,62	31,70	31,73	32,79	32,37	32,01	32,30	32,13	32,40
202853	1K2D	41,00	41,00	41,00	41,00	41,00	41,00	41,00	41,00	41,00	41,00

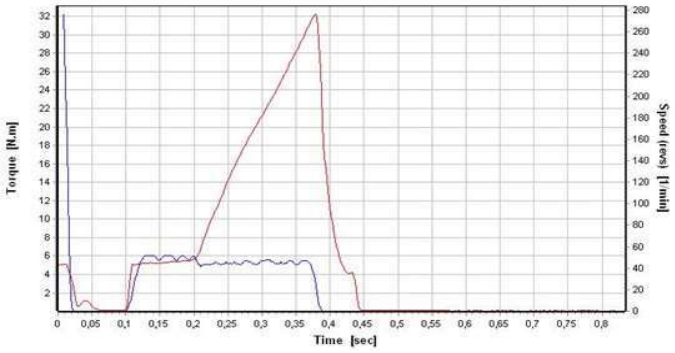
Char.No.	Char.Descr.	x_{91}	x_{92}	x_{93}	x_{94}	x_{95}	x_{96}	x_{97}	x_{98}	x_{99}	x_{100}
202853	1K2D	32,03	32,43	32,33	32,60	32,62	30,87	32,34	32,03	32,70	32,07
202853	1K2D	41,00	41,00	41,00	41,00	41,00	41,00	41,00	41,00	41,00	41,00

Torque graphs

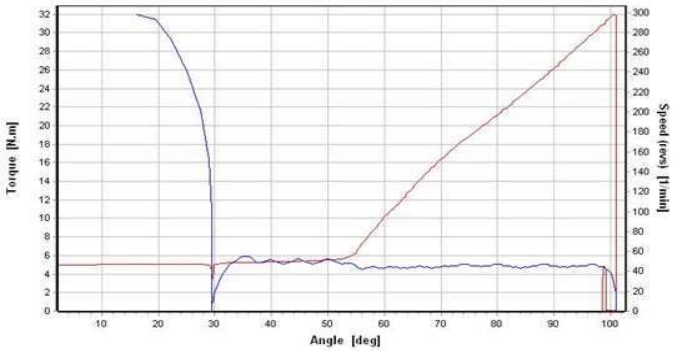
Model:	**1BD-1B060A-1K2D-1VK2D**	Serial no:	**756029**
Target torque:	**31,80 Nm**	60 % of max. torque	
Angle degree:	**40°**	Tool without angle correction	



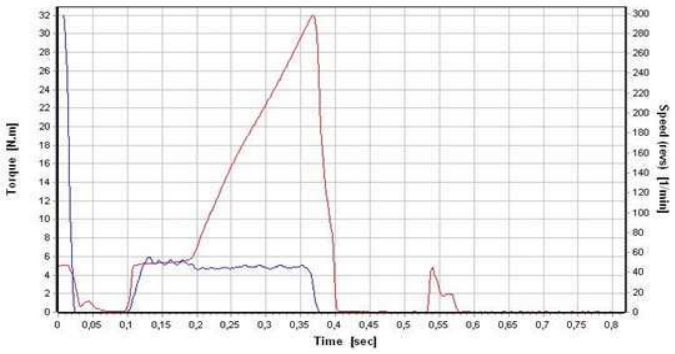
Value no. 1
Graph
Torque / Angle / Speed



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: 1BD-1B060A-1K2D-1VK2D **Serial no:** 756029

Torque range: **5,3 Nm to 53 Nm**

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

Capability examination

Snugfit value: 10,6 Nm **Torque tolerance ±** 7 %

Target torque: 42,4 Nm Tolerance: 2,19 % ± **1,09 %**

Angle degree: 180° Tolerance: 5,3° ± **2,6°**

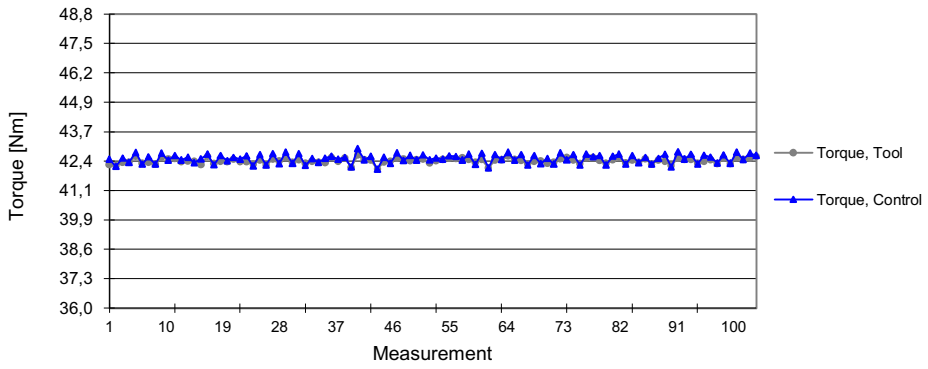
Formula derivation: $C_m = \frac{T}{6\,s}$ $T = C_m * 6\,s$

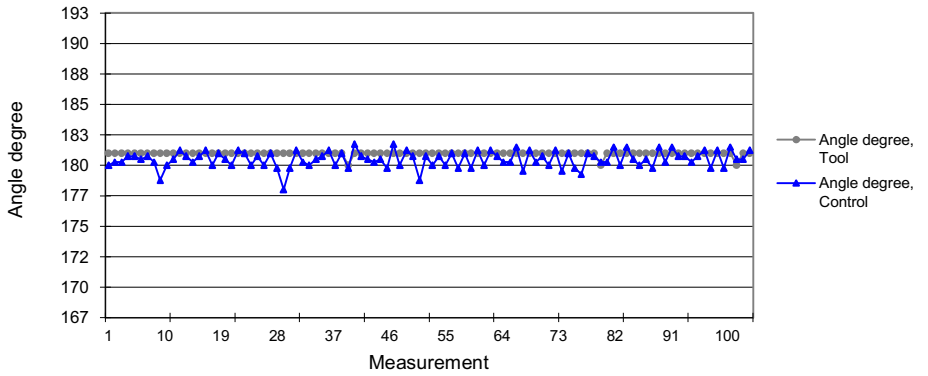
Tool without angle correction

Measurement	Tool data		Control data		Difference	
No.	Torque	Angle	Torque	Angle	Torque	Angle
1	42,24	181,00	42,47	180,00	0,23	1,00
2	42,20	181,00	42,17	180,25	0,03	0,75
3	42,34	181,00	42,53	180,25	0,19	0,75
4	42,35	181,00	42,34	180,75	0,01	0,25
5	42,61	181,00	42,77	180,75	0,16	0,25
6	42,30	181,00	42,26	180,50	0,04	0,50
7	42,34	181,00	42,59	180,75	0,25	0,25
8	42,26	181,00	42,26	180,25	0,00	0,75
9	42,56	181,00	42,74	178,75	0,18	2,25
10	42,49	181,00	42,43	180,00	0,06	1,00
11	42,50	181,00	42,64	180,50	0,14	0,50
12	42,37	181,00	42,44	181,25	0,07	0,25
13	42,40	181,00	42,57	180,75	0,17	0,25
14	42,39	181,00	42,33	180,25	0,06	0,75
15	42,24	181,00	42,49	180,75	0,25	0,25
16	42,60	181,00	42,70	181,25	0,10	0,25
17	42,29	181,00	42,24	180,00	0,05	1,00
18	42,39	181,00	42,64	181,00	0,25	0,00
19	42,37	181,00	42,41	180,50	0,04	0,50
20	42,47	181,00	42,56	180,00	0,09	1,00
21	42,37	181,00	42,47	181,25	0,10	0,25
22	42,37	181,00	42,63	181,00	0,26	0,00
23	42,26	181,00	42,19	180,00	0,07	1,00
24	42,44	181,00	42,68	180,75	0,24	0,25
25	42,23	181,00	42,22	180,00	0,01	1,00
26	42,47	181,00	42,72	181,00	0,25	0,00
27	42,40	181,00	42,29	179,75	0,11	1,25
28	42,55	181,00	42,79	178,00	0,24	3,00
29	42,34	181,00	42,30	179,75	0,04	1,25
30	42,45	181,00	42,72	181,25	0,27	0,25
31	42,30	181,00	42,21	180,25	0,09	0,75
32	42,39	181,00	42,50	180,00	0,11	1,00
33	42,35	181,00	42,34	180,50	0,01	0,50
34	42,33	181,00	42,52	180,75	0,19	0,25
35	42,56	181,00	42,61	181,25	0,05	0,25
36	42,39	181,00	42,47	180,00	0,08	1,00
37	42,53	181,00	42,56	181,00	0,03	0,00
38	42,13	180,00	42,15	179,75	0,02	0,25
39	42,66	181,00	42,93	181,75	0,27	0,75
40	42,45	181,00	42,45	180,75	0,00	0,25
41	42,44	181,00	42,61	180,50	0,17	0,50
42	42,05	181,00	42,04	180,25	0,01	0,75
43	42,36	181,00	42,57	180,50	0,21	0,50
44	42,39	181,00	42,30	179,75	0,09	1,25
45	42,51	181,00	42,76	181,75	0,25	0,75
46	42,49	181,00	42,42	180,00	0,07	1,00
47	42,41	181,00	42,65	181,25	0,24	0,25
48	42,45	181,00	42,44	180,75	0,01	0,25
49	42,48	181,00	42,67	178,75	0,19	2,25
50	42,32	181,00	42,45	180,75	0,13	0,25
51	42,41	181,00	42,53	180,00	0,12	1,00
52	42,46	181,00	42,47	180,75	0,01	0,25
53	42,51	181,00	42,63	180,00	0,12	1,00
54	42,50	181,00	42,60	181,00	0,10	0,00
55	42,54	181,00	42,44	179,75	0,10	1,25
56	42,46	181,00	42,70	181,00	0,24	0,00
57	42,35	181,00	42,25	179,75	0,10	1,25
58	42,46	181,00	42,73	181,25	0,27	0,25
59	42,11	181,00	42,11	180,00	0,00	1,00
60	42,43	181,00	42,68	181,25	0,25	0,25
61	42,45	181,00	42,46	180,75	0,01	0,25
62	42,62	181,00	42,78	180,25	0,16	0,75
63	42,46	181,00	42,43	180,25	0,03	0,75
64	42,42	181,00	42,68	181,50	0,26	0,50
65	42,28	181,00	42,22	179,50	0,06	1,50
66	42,38	181,00	42,64	181,25	0,26	0,25
67	42,40	181,00	42,29	180,25	0,11	0,75
68	42,30	181,00	42,51	180,75	0,21	0,25
69	42,35	181,00	42,28	180,00	0,07	1,00
70	42,49	181,00	42,76	181,25	0,27	0,25
71	42,56	181,00	42,45	179,50	0,11	1,50
72	42,44	181,00	42,68	181,00	0,24	0,00
73	42,29	181,00	42,22	179,75	0,07	1,25
74	42,53	181,00	42,70	179,25	0,17	1,75
75	42,56	181,00	42,59	181,00	0,03	0,00
76	42,42	181,00	42,64	180,75	0,22	0,25
77	42,30	180,00	42,23	180,25	0,07	0,25
78	42,45	181,00	42,62	180,25	0,17	0,75
79	42,57	181,00	42,70	181,50	0,13	0,50
80	42,32	181,00	42,26	180,00	0,06	1,00
81	42,43	181,00	42,64	181,50	0,21	0,50
82	42,34	181,00	42,33	180,50	0,01	0,50
83	42,49	181,00	42,56	180,00	0,07	1,00
84	42,26	181,00	42,26	180,50	0,00	0,50
85	42,43	181,00	42,51	179,75	0,08	1,25
86	42,39	181,00	42,69	181,50	0,30	0,50
87	42,21	181,00	42,15	180,25	0,06	0,75
88	42,52	181,00	42,80	181,50	0,28	0,50
89	42,46	181,00	42,48	180,75	0,02	0,25
90	42,46	181,00	42,69	180,75	0,23	0,25
91	42,30	181,00	42,28	180,25	0,02	0,75
92	42,38	181,00	42,66	180,75	0,28	0,25
93	42,45	181,00	42,58	181,25	0,13	0,25
94	42,29	181,00	42,32	179,75	0,03	1,25
95	42,51	181,00	42,67	181,25	0,16	0,25
96	42,29	181,00	42,31	179,75	0,02	1,25
97	42,55	181,00	42,79	181,50	0,24	0,50
98	42,46	180,00	42,46	180,50	0,00	0,50
99	42,51	181,00	42,74	180,50	0,23	0,50
100	42,60	181,00	42,65	181,25	0,05	0,25
				Standard deviation:	**0,093**	**0,526**

Graphical representation

Model:	**1BD-1B060A-1K2D-1VK2D**	Serial no:	**756029**
Target torque:	**42,40 Nm**	80 % of max. torque	
Angle degree:	**180°**	Tool without angle correction	





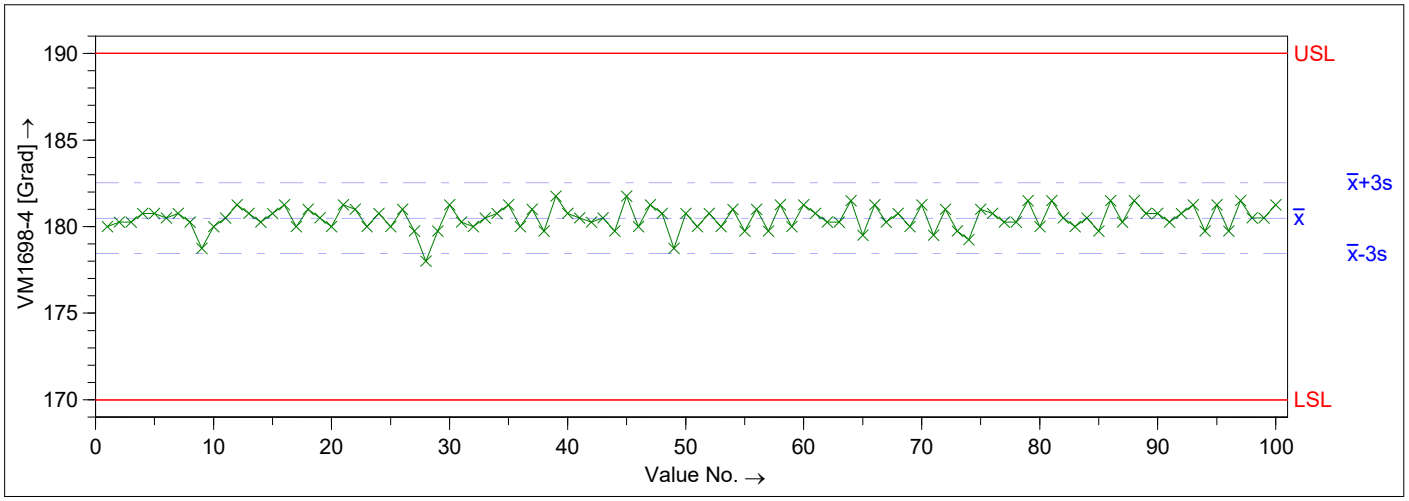
Machine Capability Study
Control System

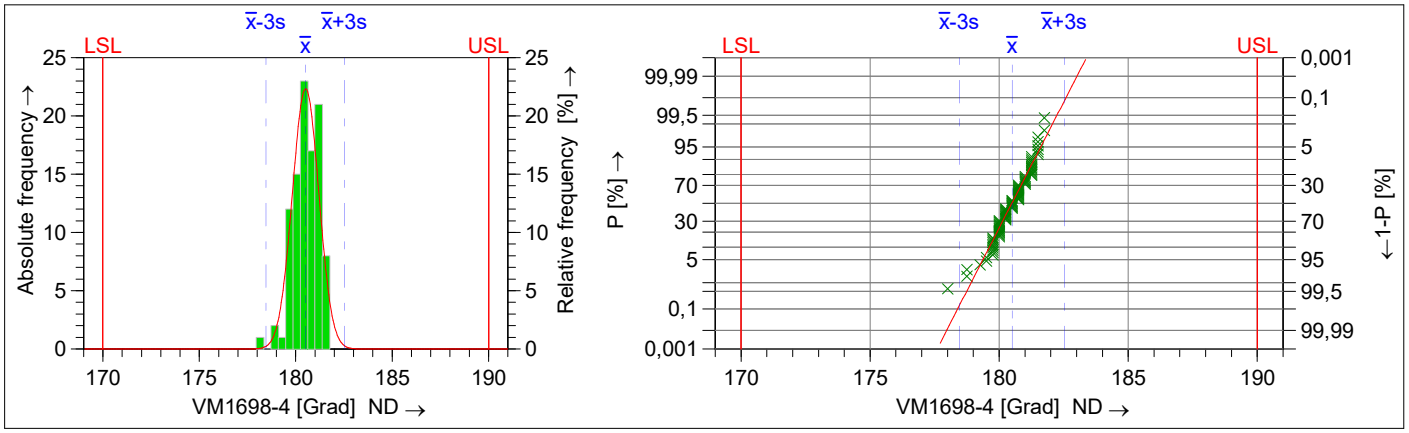
Plant	ATG Westhausen	Operator Name	Sünder
Date	03.02.2022		

Ord. No.	1BD53T2O-A	Part type	1BD-1B060A-1K2D-1VK2D	Contr.item	yes
Serial No.	756029_1	Char.Descr.	VM1698-4	Inspection Val. 180,00 10,00	USL 190,00
		Serial No.	1024210	Unit Grad -10,00	LSL 170,00
Char.Type	variable			Tolerance value 6 %	Decimal Pl. 2
Cust.Name	Cleco	Reference System	VM1698-4	Test Electronic	MPRO400GCD-P
Contr.No.	Homologation	Reference Transducer	50 / 1024729	nges.	100

Evaluation from 03.02.2022 15:11:47 to 03.02.2022 15:27:33

Rem. TQ 80% Angle 180° +/-10° * TQ-Cal.: 60.0 Nm; Cur-Cal.: 3.8391 Nm/A; Speed: 300/50 rpm;





Drawing Values		Collected Values		Statistics	
T_m	180.00			$\bar{x}$	180.4900
LSL	170.00	x_{min}	178.00	$\bar{x}$-3s	178.4536
USL	190.00	x_{max}	181.75	$\bar{x}$+3s	182.5264
T	20.00	R	3.75	6s	4.0727
		$n_{<T>}$	100	$p_{<T>}$	100.00000 %
		$n_{>USL}$	0	$p_{>USL}$	0.00000%
		$n_{<LSL}$	0	$p_{<LSL}$	0.00000%
		n_{eff}	100		
		n_{tot}	100		

Model distribution			Normal Distribution
Calculation method			$M1_{1.4}$ $\hat{\sigma} = s_{tot}$
Potential Capability index	=	C_m	4.91
Critical capability index	=	C_{mk}	4.67

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 03.02.2022

Ser.No.	756029_I	Characteristic			
Type	1BD-1B060A-1K2D-1VK2D	Char.Descr.	VM1698-4	Inspection Val.	42,40
Ord. No.	1BD53T2O-A	Ser.No.	1024210	LSL	39,43
				USL	45,37
Remark	TQ 80% Angle 180°+/-10°* TQ-Cal.: 60.0 Nm; Cur-Cal.: 3.8391 Nm/A; Speed: 300/50 rpm;				

Char.No.	Char.Descr.	x_1	x_2	x_3	x_4	x_5	x_6	x_7	x_8	x_9	x_{10}
1024210	VM1698-4	42,47	42,17	42,53	42,34	42,77	42,26	42,59	42,26	42,74	42,43
1024210	VM1698-4	180,00	180,25	180,25	180,75	180,75	180,50	180,75	180,25	178,75	180,00

Char.No.	Char.Descr.	x_{11}	x_{12}	x_{13}	x_{14}	x_{15}	x_{16}	x_{17}	x_{18}	x_{19}	x_{20}
1024210	VM1698-4	42,64	42,44	42,57	42,33	42,49	42,70	42,24	42,64	42,41	42,56
1024210	VM1698-4	180,50	181,25	180,75	180,25	180,75	181,25	180,00	181,00	180,50	180,00

Char.No.	Char.Descr.	x_{21}	x_{22}	x_{23}	x_{24}	x_{25}	x_{26}	x_{27}	x_{28}	x_{29}	x_{30}
1024210	VM1698-4	42,47	42,63	42,19	42,68	42,22	42,72	42,29	42,79	42,30	42,72
1024210	VM1698-4	181,25	181,00	180,00	180,75	180,00	181,00	179,75	178,00	179,75	181,25

Char.No.	Char.Descr.	x_{31}	x_{32}	x_{33}	x_{34}	x_{35}	x_{36}	x_{37}	x_{38}	x_{39}	x_{40}
1024210	VM1698-4	42,21	42,50	42,34	42,52	42,61	42,47	42,56	42,15	42,93	42,45
1024210	VM1698-4	180,25	180,00	180,50	180,75	181,25	180,00	181,00	179,75	181,75	180,75

Char.No.	Char.Descr.	x_{41}	x_{42}	x_{43}	x_{44}	x_{45}	x_{46}	x_{47}	x_{48}	x_{49}	x_{50}
1024210	VM1698-4	42,61	42,04	42,57	42,30	42,76	42,42	42,65	42,44	42,67	42,45
1024210	VM1698-4	180,50	180,25	180,50	179,75	181,75	180,00	181,25	180,75	178,75	180,75

Char.No.	Char.Descr.	x_{51}	x_{52}	x_{53}	x_{54}	x_{55}	x_{56}	x_{57}	x_{58}	x_{59}	x_{60}
1024210	VM1698-4	42,53	42,47	42,63	42,60	42,44	42,70	42,25	42,73	42,11	42,68
1024210	VM1698-4	180,00	180,75	180,00	181,00	179,75	181,00	179,75	181,25	180,00	181,25

Char.No.	Char.Descr.	x_{61}	x_{62}	x_{63}	x_{64}	x_{65}	x_{66}	x_{67}	x_{68}	x_{69}	x_{70}
1024210	VM1698-4	42,46	42,78	42,43	42,68	42,22	42,64	42,29	42,51	42,28	42,76
1024210	VM1698-4	180,75	180,25	180,25	181,50	179,50	181,25	180,25	180,75	180,00	181,25

Char.No.	Char.Descr.	x_{71}	x_{72}	x_{73}	x_{74}	x_{75}	x_{76}	x_{77}	x_{78}	x_{79}	x_{80}
1024210	VM1698-4	42,45	42,68	42,22	42,70	42,59	42,64	42,23	42,62	42,70	42,26
1024210	VM1698-4	179,50	181,00	179,75	179,25	181,00	180,75	180,25	180,25	181,50	180,00

Machine Capability Study
Control System

Plant	ATG Westhausen		Operator Name	Sünder	Date 03.02.2022

Ser.No.	756029_I	Characteristic			
Type	1BD-1B060A-1K2D-1VK2D	Char.Descr.	VM1698-4	Inspection Val.	42,40
Ord. No.	1BD53T2O-A	Ser.No.	1024210	LSL	39,43
				USL	45,37
Remark	TQ 80% Angle 180°+/-10°* TQ-Cal.: 60.0 Nm; Cur-Cal.: 3.8391 Nm/A; Speed: 300/50 rpm;				

Char.No.	Char.Descr.	x_{81}	x_{82}	x_{83}	x_{84}	x_{85}	x_{86}	x_{87}	x_{88}	x_{89}	x_{90}
1024210	VM1698-4	42,64	42,33	42,56	42,26	42,51	42,69	42,15	42,80	42,48	42,69
1024210	VM1698-4	181,50	180,50	180,00	180,50	179,75	181,50	180,25	181,50	180,75	180,75

Char.No.	Char.Descr.	x_{91}	x_{92}	x_{93}	x_{94}	x_{95}	x_{96}	x_{97}	x_{98}	x_{99}	x_{100}
1024210	VM1698-4	42,28	42,66	42,58	42,32	42,67	42,31	42,79	42,46	42,74	42,65
1024210	VM1698-4	180,25	180,75	181,25	179,75	181,25	179,75	181,50	180,50	180,50	181,25

Machine Capability Study
Tool System

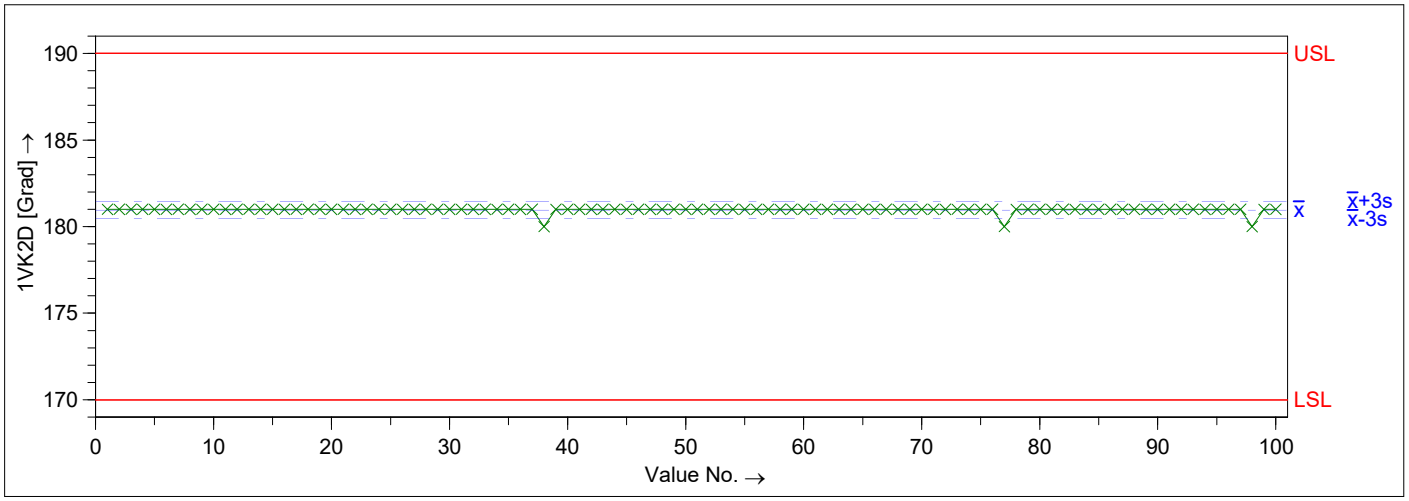
Cleco Production Tools

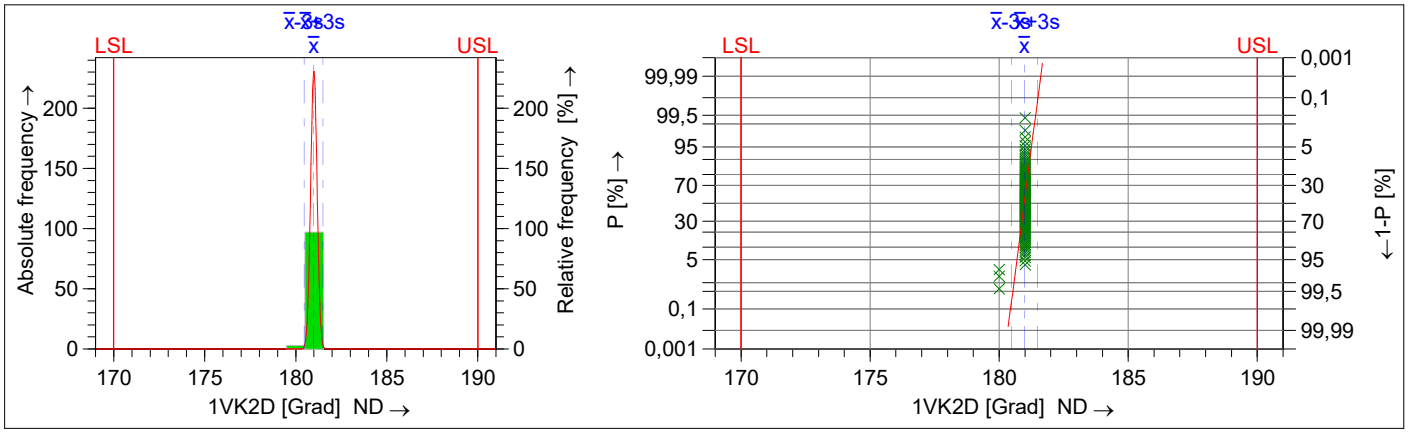
Plant	ATG Westhausen	Operator Name	Sünder
Date	03.02.2022		

Ord. No.	1BD53T2O-A	Part type	1BD-1B060A-1K2D-1VK2D	Contr.item	yes
Serial No.	756029_1	Char.Descr.	1VK2D	Inspection Val. 180,00 10,00	USL 190,00
		Serial No.	200694_1	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	50 / 1024729	nges.	100

Evaluation from 03.02.2022 15:11:47 to 03.02.2022 15:27:33

Rem. TQ 80% Angle 180° +/-10° * TQ-Cal.: 60.0 Nm; Cur-Cal.: 3.8391 Nm/A; Speed: 300/50 rpm;





Drawing Values		Collected Values		Statistics	
T_m	180.00			$\bar{x}$	180.9700
LSL	170.00	x_{min}	180.00	$\bar{x}$-3s	180.4557
USL	190.00	x_{max}	181.00	$\bar{x}$+3s	181.4843
T	20.00	R	1.00	6s	1.0287
		$n_{<T>}$	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	19.44
Critical capability index	=	C_{mk}	17.56

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 03.02.2022

Ser.No.	756029_l	Characteristic			
Type	1BD-1B060A-1K2D-1VK2D	Char.Descr.	1VK2D	Inspection Val.	42,40
Ord. No.	1BD53T2O-A	Ser.No.	200694_1	LSL	39,43
				USL	45,37
Remark	TQ 80% Angle 180°+/-10°* TQ-Cal.: 60.0 Nm; Cur-Cal.: 3.8391 Nm/A; Speed: 300/50 rpm;				

Char.No.	Char.Descr.	x_1	x_2	x_3	x_4	x_5	x_6	x_7	x_8	x_9	x_{10}
200694_	1VK2D	42,24	42,20	42,34	42,35	42,61	42,30	42,34	42,26	42,56	42,49
200694_	1VK2D	181,00	181,00	181,00	181,00	181,00	181,00	181,00	181,00	181,00	181,00

Char.No.	Char.Descr.	x_{11}	x_{12}	x_{13}	x_{14}	x_{15}	x_{16}	x_{17}	x_{18}	x_{19}	x_{20}
200694_	1VK2D	42,50	42,37	42,40	42,39	42,24	42,60	42,29	42,39	42,37	42,47
200694_	1VK2D	181,00	181,00	181,00	181,00	181,00	181,00	181,00	181,00	181,00	181,00

Char.No.	Char.Descr.	x_{21}	x_{22}	x_{23}	x_{24}	x_{25}	x_{26}	x_{27}	x_{28}	x_{29}	x_{30}
200694_	1VK2D	42,37	42,37	42,26	42,44	42,23	42,47	42,40	42,55	42,34	42,45
200694_	1VK2D	181,00	181,00	181,00	181,00	181,00	181,00	181,00	181,00	181,00	181,00

Char.No.	Char.Descr.	x_{31}	x_{32}	x_{33}	x_{34}	x_{35}	x_{36}	x_{37}	x_{38}	x_{39}	x_{40}
200694_	1VK2D	42,30	42,39	42,35	42,33	42,56	42,39	42,53	42,13	42,66	42,45
200694_	1VK2D	181,00	181,00	181,00	181,00	181,00	181,00	181,00	180,00	181,00	181,00

Char.No.	Char.Descr.	x_{41}	x_{42}	x_{43}	x_{44}	x_{45}	x_{46}	x_{47}	x_{48}	x_{49}	x_{50}
200694_	1VK2D	42,44	42,05	42,36	42,39	42,51	42,49	42,41	42,45	42,48	42,32
200694_	1VK2D	181,00	181,00	181,00	181,00	181,00	181,00	181,00	181,00	181,00	181,00

Char.No.	Char.Descr.	x_{51}	x_{52}	x_{53}	x_{54}	x_{55}	x_{56}	x_{57}	x_{58}	x_{59}	x_{60}
200694_	1VK2D	42,41	42,46	42,51	42,50	42,54	42,46	42,35	42,46	42,11	42,43
200694_	1VK2D	181,00	181,00	181,00	181,00	181,00	181,00	181,00	181,00	181,00	181,00

Char.No.	Char.Descr.	x_{61}	x_{62}	x_{63}	x_{64}	x_{65}	x_{66}	x_{67}	x_{68}	x_{69}	x_{70}
200694_	1VK2D	42,45	42,62	42,46	42,42	42,28	42,38	42,40	42,30	42,35	42,49
200694_	1VK2D	181,00	181,00	181,00	181,00	181,00	181,00	181,00	181,00	181,00	181,00

Char.No.	Char.Descr.	x_{71}	x_{72}	x_{73}	x_{74}	x_{75}	x_{76}	x_{77}	x_{78}	x_{79}	x_{80}
200694_	1VK2D	42,56	42,44	42,29	42,53	42,56	42,42	42,30	42,45	42,57	42,32
200694_	1VK2D	181,00	181,00	181,00	181,00	181,00	181,00	180,00	181,00	181,00	181,00

Machine Capability Study
Tool System

Plant	ATG Westhausen		Operator Name	Sünder	Date 03.02.2022

Ser.No.	756029_l	Characteristic			
Type	1BD-1B060A-1K2D-1VK2D	Char.Descr.	1VK2D	Inspection Val.	42,40
Ord. No.	1BD53T2O-A	Ser.No.	200694_1	LSL	39,43
				USL	45,37
Remark	TQ 80% Angle 180°+/-10°* TQ-Cal.: 60.0 Nm; Cur-Cal.: 3.8391 Nm/A; Speed: 300/50 rpm;				

Char.No.	Char.Descr.	x_{81}	x_{82}	x_{83}	x_{84}	x_{85}	x_{86}	x_{87}	x_{88}	x_{89}	x_{90}
200694_	1VK2D	42,43	42,34	42,49	42,26	42,43	42,39	42,21	42,52	42,46	42,46
200694_	1VK2D	181,00	181,00	181,00	181,00	181,00	181,00	181,00	181,00	181,00	181,00

Char.No.	Char.Descr.	x_{91}	x_{92}	x_{93}	x_{94}	x_{95}	x_{96}	x_{97}	x_{98}	x_{99}	x_{100}
200694_	1VK2D	42,30	42,38	42,45	42,29	42,51	42,29	42,55	42,46	42,51	42,60
200694_	1VK2D	181,00	181,00	181,00	181,00	181,00	181,00	181,00	180,00	181,00	181,00

Machine Capability Study
Tool System

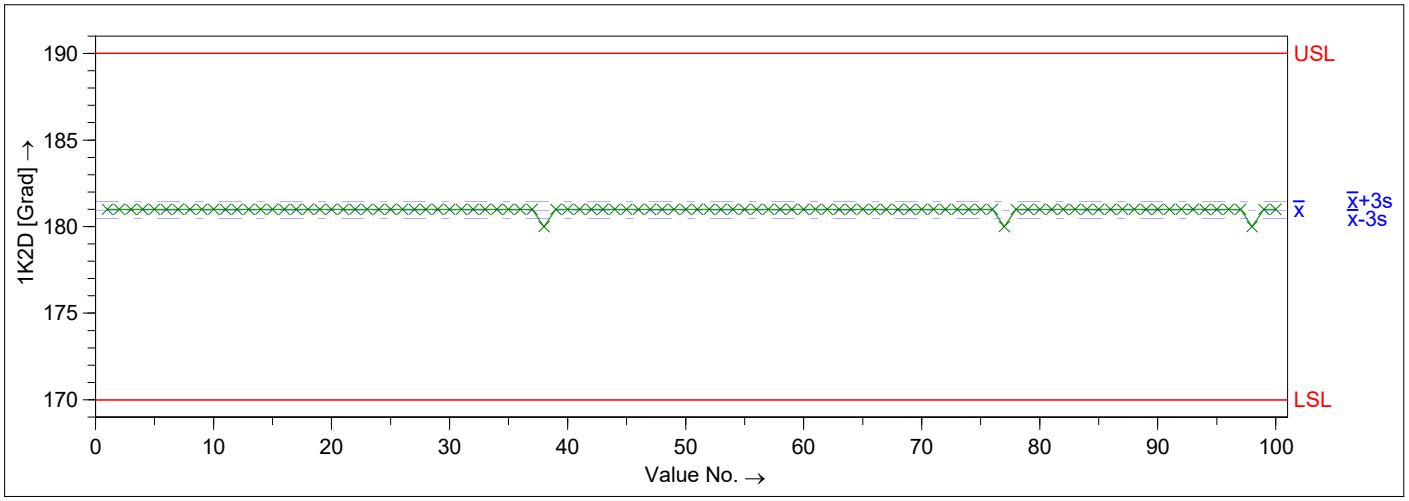
Cleco Production Tools

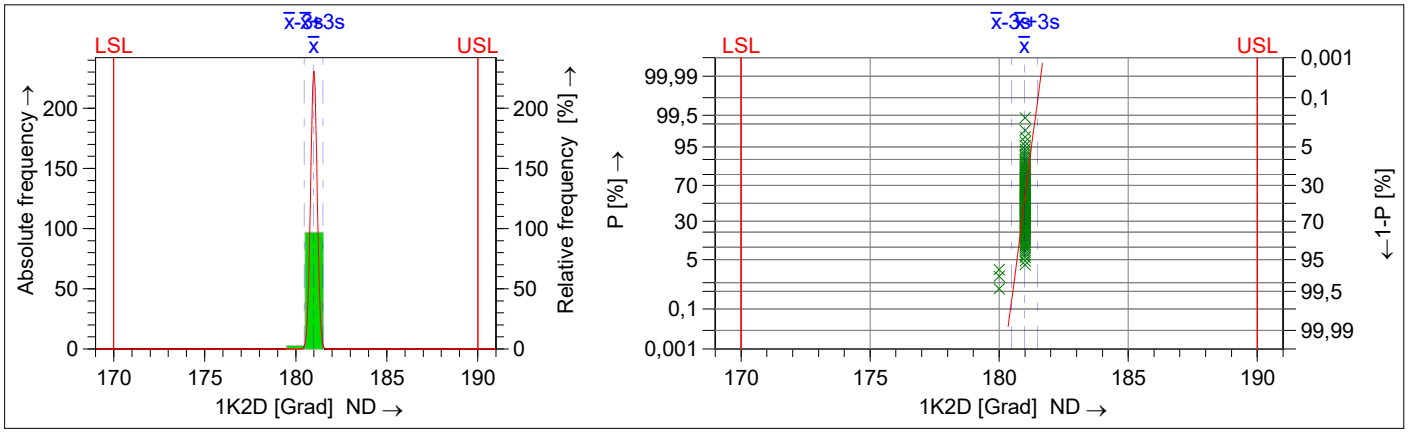
Plant	ATG Westhausen	Operator Name	Sünder
Date	03.02.2022		

Ord. No.	1BD53T2O-A	Part type	1BD-1B060A-1K2D-1VK2D	Contr.item	yes
Serial No.	756029_1	Char.Descr.	1K2D	Inspection Val. 180,00 10,00	USL 190,00
		Serial No.	202853	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	50 / 1024729	nges.	100

Evaluation from 03.02.2022 15:11:47 to 03.02.2022 15:27:34

Rem. TQ 80% Angle 180° +/-10° * TQ-Cal.: 60.0 Nm; Cur-Cal.: 3.8391 Nm/A; Speed: 300/50 rpm;





Drawing Values		Collected Values		Statistics	
T_m	180.00			$\bar{x}$	180.9700
LSL	170.00	x_{min}	180.00	$\bar{x}$-3s	180.4557
USL	190.00	x_{max}	181.00	$\bar{x}$+3s	181.4843
T	20.00	R	1.00	6s	1.0287
		$n_{<T>}$	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	19.44
Critical capability index	=	C_{mk}	17.56

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 03.02.2022

Ser.No.	756029_I	Characteristic			
Type	1BD-1B060A-1K2D-1VK2D	Char.Descr.	1K2D	Inspection Val.	42,40
Ord. No.	1BD53T2O-A	Ser.No.	202853	LSL	39,43
				USL	45,37
Remark	TQ 80% Angle 180°+/-10°* TQ-Cal.: 60.0 Nm; Cur-Cal.: 3.8391 Nm/A; Speed: 300/50 rpm;				

Char.No.	Char.Descr.	x_1	x_2	x_3	x_4	x_5	x_6	x_7	x_8	x_9	x_{10}
202853	1K2D	42,01	42,25	42,61	42,80	43,03	42,16	42,66	42,49	42,55	42,79
202853	1K2D	181,00	181,00	181,00	181,00	181,00	181,00	181,00	181,00	181,00	181,00

Char.No.	Char.Descr.	x_{11}	x_{12}	x_{13}	x_{14}	x_{15}	x_{16}	x_{17}	x_{18}	x_{19}	x_{20}
202853	1K2D	42,61	41,97	42,35	42,12	42,32	43,19	42,33	42,67	42,51	42,53
202853	1K2D	181,00	181,00	181,00	181,00	181,00	181,00	181,00	181,00	181,00	181,00

Char.No.	Char.Descr.	x_{21}	x_{22}	x_{23}	x_{24}	x_{25}	x_{26}	x_{27}	x_{28}	x_{29}	x_{30}
202853	1K2D	42,56	42,23	41,79	42,92	41,75	42,58	42,02	42,99	42,57	42,69
202853	1K2D	181,00	181,00	181,00	181,00	181,00	181,00	181,00	181,00	181,00	181,00

Char.No.	Char.Descr.	x_{31}	x_{32}	x_{33}	x_{34}	x_{35}	x_{36}	x_{37}	x_{38}	x_{39}	x_{40}
202853	1K2D	41,77	42,76	42,40	42,72	42,27	42,29	42,12	42,38	42,52	42,12
202853	1K2D	181,00	181,00	181,00	181,00	181,00	181,00	181,00	180,00	181,00	181,00

Char.No.	Char.Descr.	x_{41}	x_{42}	x_{43}	x_{44}	x_{45}	x_{46}	x_{47}	x_{48}	x_{49}	x_{50}
202853	1K2D	42,68	41,63	42,33	42,74	42,96	42,57	42,97	42,48	42,86	42,67
202853	1K2D	181,00	181,00	181,00	181,00	181,00	181,00	181,00	181,00	181,00	181,00

Char.No.	Char.Descr.	x_{51}	x_{52}	x_{53}	x_{54}	x_{55}	x_{56}	x_{57}	x_{58}	x_{59}	x_{60}
202853	1K2D	42,44	42,91	42,61	42,86	42,72	42,78	42,09	42,85	41,76	42,87
202853	1K2D	181,00	181,00	181,00	181,00	181,00	181,00	181,00	181,00	181,00	181,00

Char.No.	Char.Descr.	x_{61}	x_{62}	x_{63}	x_{64}	x_{65}	x_{66}	x_{67}	x_{68}	x_{69}	x_{70}
202853	1K2D	42,47	42,32	42,22	42,59	42,26	42,30	42,12	42,56	42,62	42,81
202853	1K2D	181,00	181,00	181,00	181,00	181,00	181,00	181,00	181,00	181,00	181,00

Char.No.	Char.Descr.	x_{71}	x_{72}	x_{73}	x_{74}	x_{75}	x_{76}	x_{77}	x_{78}	x_{79}	x_{80}
202853	1K2D	42,39	42,54	41,95	42,91	42,96	42,28	42,41	42,21	42,78	42,10
202853	1K2D	181,00	181,00	181,00	181,00	181,00	181,00	180,00	181,00	181,00	181,00

Machine Capability Study
Tool System

Plant	ATG Westhausen		Operator Name	Sünder	Date 03.02.2022

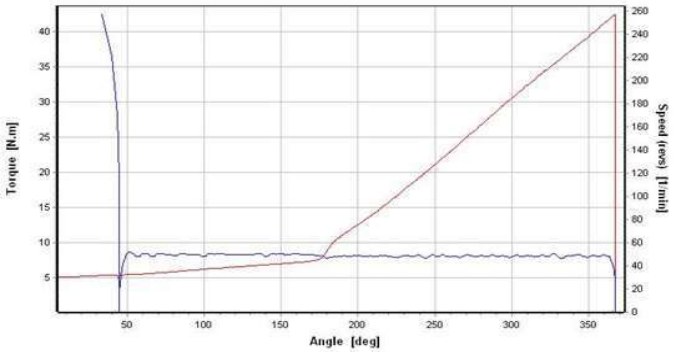
Ser.No.	756029_I	Characteristic			
Type	1BD-1B060A-1K2D-1VK2D	Char.Descr.	1K2D	Inspection Val.	42,40
Ord. No.	1BD53T2O-A	Ser.No.	202853	LSL	39,43
				USL	45,37
Remark	TQ 80% Angle 180°+/-10°* TQ-Cal.: 60.0 Nm; Cur-Cal.: 3.8391 Nm/A; Speed: 300/50 rpm;				

Char.No.	Char.Descr.	x_{81}	x_{82}	x_{83}	x_{84}	x_{85}	x_{86}	x_{87}	x_{88}	x_{89}	x_{90}
202853	1K2D	42,38	41,92	42,53	42,36	42,72	42,29	41,80	42,96	42,32	42,43
202853	1K2D	181,00	181,00	181,00	181,00	181,00	181,00	181,00	181,00	181,00	181,00

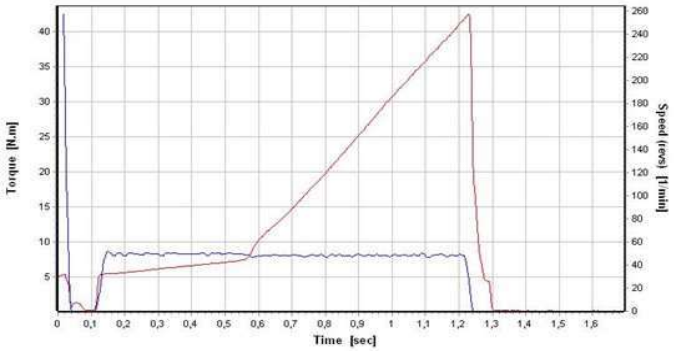
Char.No.	Char.Descr.	x_{91}	x_{92}	x_{93}	x_{94}	x_{95}	x_{96}	x_{97}	x_{98}	x_{99}	x_{100}
202853	1K2D	42,51	42,71	42,92	42,31	42,83	42,28	42,43	42,00	42,32	42,59
202853	1K2D	181,00	181,00	181,00	181,00	181,00	181,00	181,00	180,00	181,00	181,00

Torque graphs

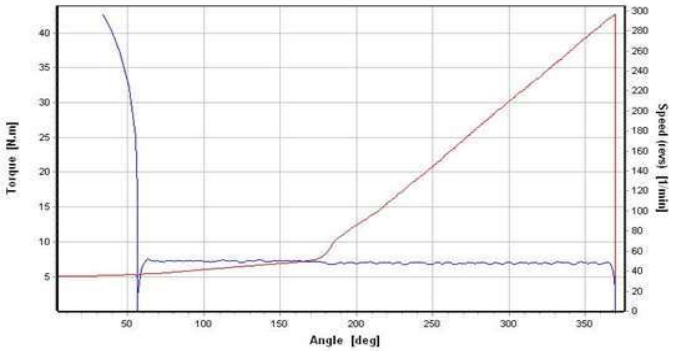
Model:	**1BD-1B060A-1K2D-1VK2D**	Serial no:	**756029**
Target torque:	**42,40 Nm**	80 % of max. torque	
Angle degree:	**180°**	Tool without angle correction	



Value no. 1
Graph
Torque / Angle / Speed



Value no. 1
Graph
Torque / Time / Speed



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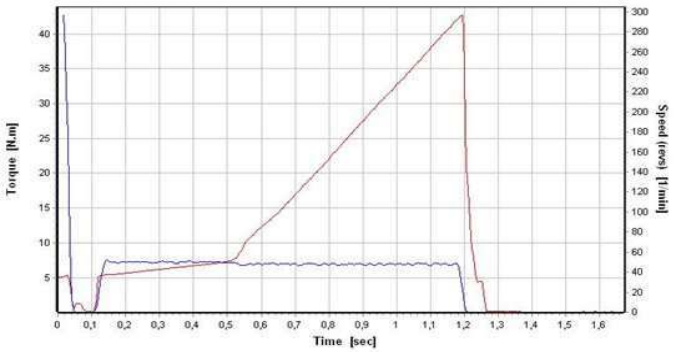
Graph
Torque / Angle / Speed



Value no. 100
Graph
Torque / Time / Speed