Homologation

Fixtured Spindle

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

Serial no.: 756027

Contents

Homologation: 1BD-1B060A-1K2D-1VK2D SN: 756027

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Test sheet no. 2

Machine Capability Study 30 %

Multi-stage tightening system	☑	Speed 50 rpm	7,14 %
Single-stage tightening system	☐	Speed 100 %	700 rpm

Manufacturer: Apex Tool Group Serial no: **756027**

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

Hard joint (H)	118,65	Nm / Revolution	Angle degree	30°
Soft joint (L)	9,81	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	19,77	19,62 Nm
	Standard deviation	0,07	0,05 Nm
	Torque scatter (99,73%)	0,40	0,28 Nm
	C_m	6,81	9,66
	C_{mk}	6,00	9,60

b) Min. C_m hard/soft (lowest value) 6,81
Min. C_{mk} hard/soft (lowest value) 6,00

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

Note:

Machine Capability Study
Control System

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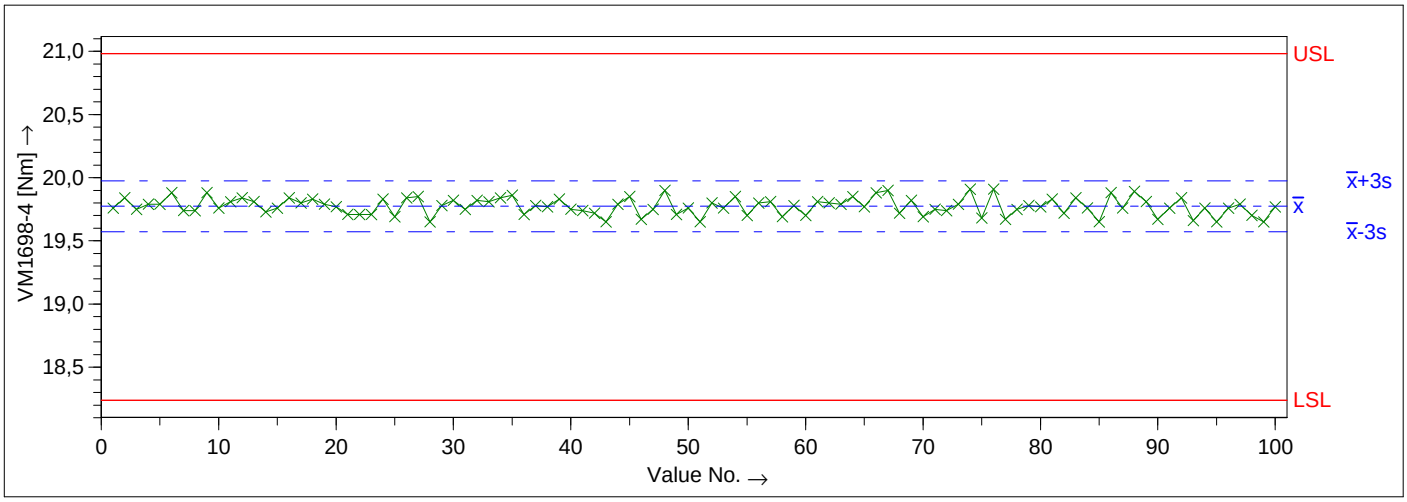
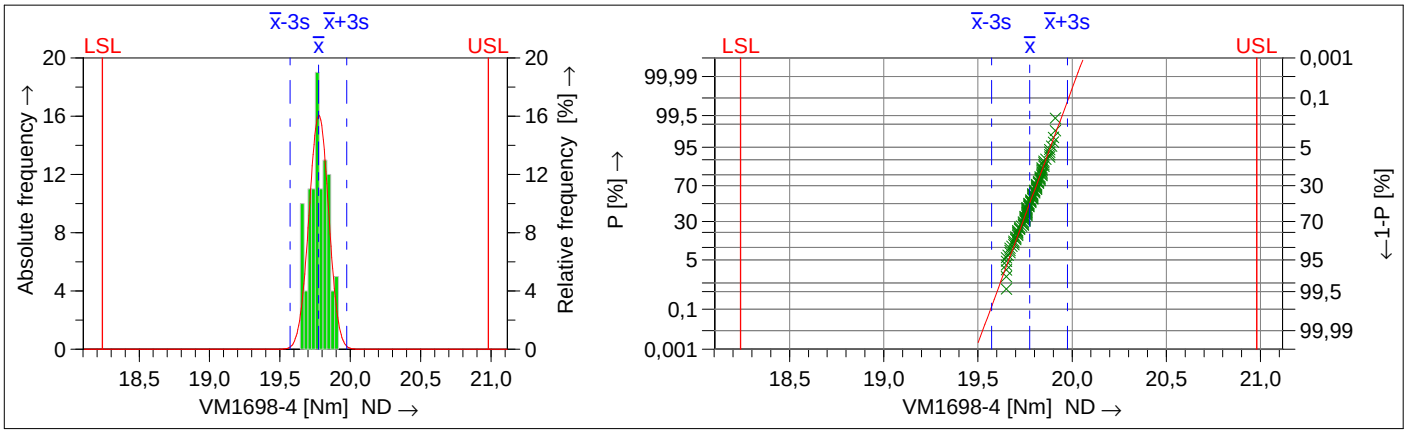
Plant	ATG Westhausen	Operator Name	Sünder
Date	02.02.2022		

Ord. No.	1BD53T2O-A	Part type	1BD-1B060A-1K2D-1VK2D	Contr.item	yes
Serial No.	756027_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 02.02.2022 08:44:28 to 02.02.2022 08:58:21

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			$\bar{x}$	19.7743
LSL	18.24	x_{min}	19.65	$\bar{x}$-3s	19.5732
USL	20.98	x_{max}	19.91	$\bar{x}$+3s	19.9754
T	2.74	R	0.26	6s	0.4022
		$n_{<T>}$	100	$p_{<T>}$	100.00000 %
		$n_{>USL}$	0	$p_{>USL}$	0.00000%
		$n_{<LSL}$	0	$p_{<LSL}$	0.00000%
		n_{eff}	100		
		n_{tot}	100		

Model distribution			Normal Distribution
Calculation method			$M1_{1.4}$ $\hat{\sigma} = s_{tot}$
Potential Capability index	=	C_m	6.81
Critical capability index	=	C_{mk}	6.00

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 02.02.2022

Ser.No.	756027_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	19,76	19,84	19,75	19,79	19,79	19,88	19,74	19,74	19,88	19,76
1024210	VM1698-4	31,00	31,50	31,25	31,25	31,25	31,50	31,50	30,75	31,25	31,00

Char.No	Char.Descr.	x_{11}	x_{12}	x_{13}	x_{14}	x_{15}	x_{16}	x_{17}	x_{18}	x_{19}	x_{20}
1024210	VM1698-4	19,81	19,84	19,81	19,73	19,76	19,84	19,80	19,83	19,79	19,77
1024210	VM1698-4	31,00	31,25	31,25	30,25	30,00	30,75	30,50	30,50	30,25	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	19,71	19,71	19,71	19,83	19,69	19,84	19,85	19,65	19,78	19,82
1024210	VM1698-4	30,50	30,50	30,50	30,50	30,25	30,50	30,50	30,00	30,50	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}
1024210	VM1698-4	19,75	19,82	19,81	19,84	19,86	19,71	19,78	19,77	19,83	19,75
1024210	VM1698-4	30,50	30,50	30,50	30,75	30,75	30,25	30,50	30,50	30,50	30,25

Char.No	Char.Descr.	x_{41}	x_{42}	x_{43}	x_{44}	x_{45}	x_{46}	x_{47}	x_{48}	x_{49}	x_{50}
1024210	VM1698-4	19,74	19,72	19,65	19,79	19,85	19,67	19,75	19,90	19,71	19,76
1024210	VM1698-4	30,25	30,00	30,00	30,75	30,50	30,25	30,25	30,75	30,50	30,50

Char.No	Char.Descr.	x_{51}	x_{52}	x_{53}	x_{54}	x_{55}	x_{56}	x_{57}	x_{58}	x_{59}	x_{60}
1024210	VM1698-4	19,65	19,80	19,76	19,85	19,70	19,80	19,81	19,69	19,78	19,70
1024210	VM1698-4	30,25	30,25	30,25	30,25	30,50	30,25	30,50	30,00	30,50	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}
1024210	VM1698-4	19,81	19,80	19,79	19,85	19,77	19,88	19,90	19,72	19,82	19,69
1024210	VM1698-4	30,25	30,25	30,25	30,75	30,75	30,25	30,50	30,25	30,50	30,50

Char.No	Char.Descr.	x_{71}	x_{72}	x_{73}	x_{74}	x_{75}	x_{76}	x_{77}	x_{78}	x_{79}	x_{80}
1024210	VM1698-4	19,75	19,74	19,79	19,91	19,68	19,91	19,67	19,75	19,78	19,77
1024210	VM1698-4	30,50	30,50	30,25	30,50	30,25	30,75	30,25	30,50	30,50	30,25

Machine Capability Study
Control System

Plant	ATG Westhausen		Operator Name	Sünder	Date 02.02.2022

Ser.No.	756027_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	19,83	19,72	19,84	19,76	19,65	19,88	19,76	19,89	19,81	19,67
1024210	VM1698-4	30,25	30,50	30,25	30,50	30,25	30,50	30,00	30,50	30,50	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	19,76	19,84	19,66	19,76	19,65	19,76	19,79	19,70	19,65	19,77
1024210	VM1698-4	30,00	30,50	30,25	30,25	29,75	30,25	30,00	30,00	30,25	30,25

Machine Capability Study
Tool System

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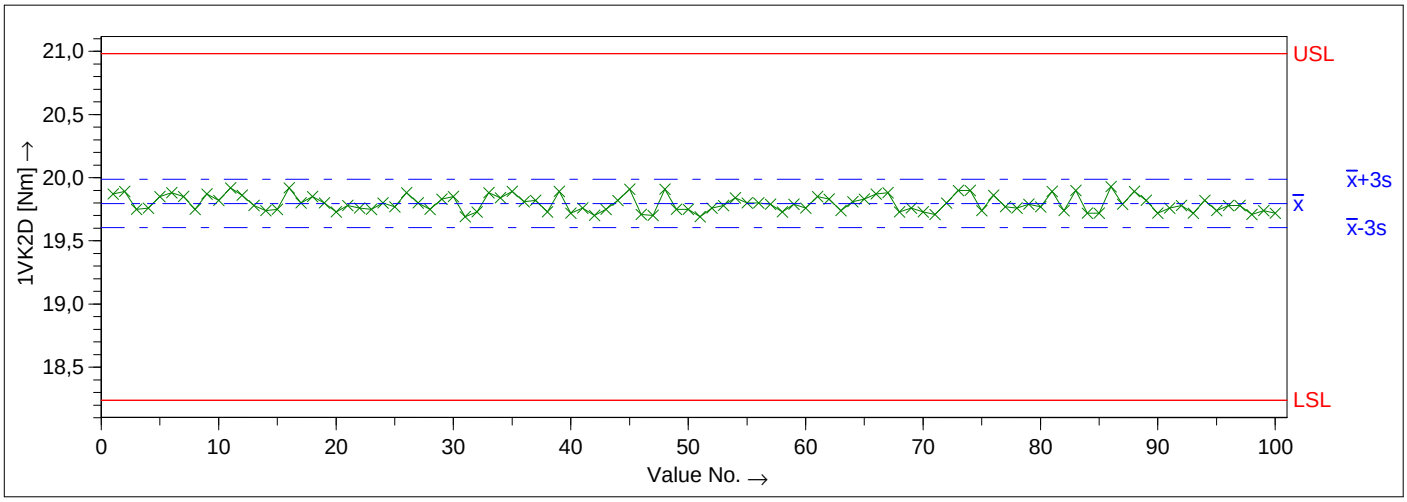
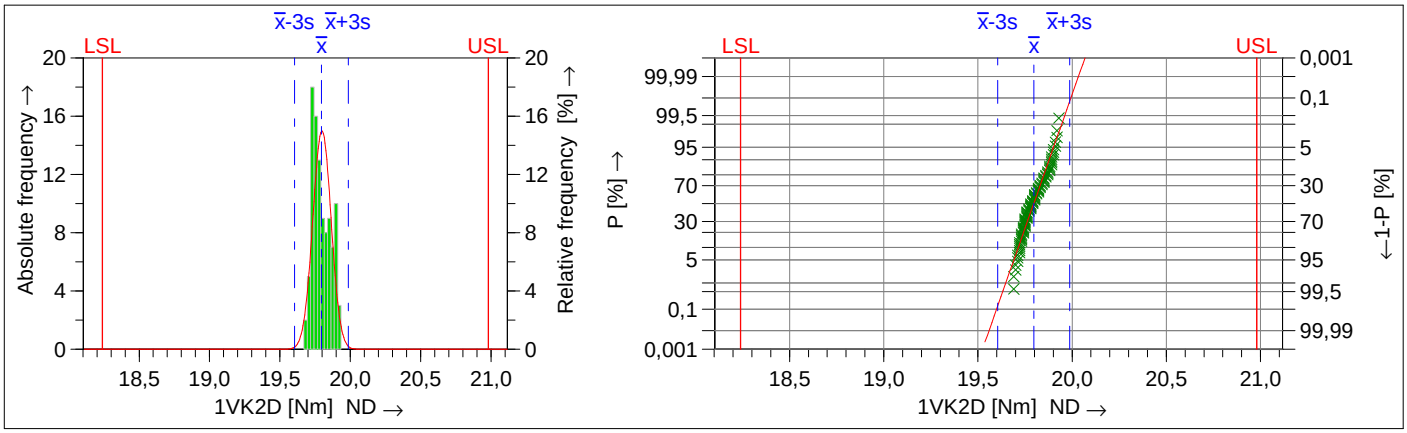
Plant	ATG Westhausen	Operator Name	Sünder
Date	02.02.2022		

Ord. No.	1BD53T2O-A	Part type	1BD-1B060A-1K2D-1VK2D	Contr.item	yes
Serial No.	756027_d	Char.Descr.	1VK2D	Inspection Val. 19,61 1,37	USL 20,98
		Serial No.	200692_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 02.02.2022 08:44:28 to 02.02.2022 08:58:21

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			$\bar{x}$	19.7961
LSL	18.24	x_{min}	19.69	$\bar{x}$-3s	19.6047
USL	20.98	x_{max}	19.93	$\bar{x}$+3s	19.9875
T	2.74	R	0.24	6s	0.3829
		$n_{<T>}$	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	7.16
Critical capability index	=	C_{mk}	6.18

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

APEX VDI/VDE 2647 V0.1

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Machine Capability Study
Tool System

Plant	ATG Westhausen		Operator Name	Sünder	Date 02.02.2022

Ser.No.	756027_d	Characteristic			
Type	1BD-1B060A-1K2D-1VK2D	Char.Descr.	1VK2D	Inspection Val.	19,61
Ord. No.	1BD53T2O-A	Ser.No.	200692_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}
200692_	1VK2D	19,87	19,89	19,75	19,76	19,85	19,88	19,85	19,75	19,87	19,82
200692_	1VK2D	31,00	31,00	31,00	31,00	31,00	31,00	31,00	30,00	31,00	31,00

Char.No	Char.Descr.	x_{11}	x_{12}	x_{13}	x_{14}	x_{15}	x_{16}	x_{17}	x_{18}	x_{19}	x_{20}
200692_	1VK2D	19,92	19,86	19,78	19,74	19,75	19,92	19,80	19,85	19,80	19,73
200692_	1VK2D	31,00	31,00	31,00	30,00	29,00	31,00	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}
200692_	1VK2D	19,78	19,76	19,75	19,80	19,77	19,88	19,80	19,75	19,83	19,85
200692_	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_{31}	x_{32}	x_{33}	x_{34}	x_{35}	x_{36}	x_{37}	x_{38}	x_{39}	x_{40}
200692_	1VK2D	19,69	19,73	19,88	19,84	19,89	19,81	19,82	19,73	19,89	19,72
200692_	1VK2D	30,00	30,00	31,00	30,00	31,00	30,00	31,00	30,00	30,00	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}
200692_	1VK2D	19,76	19,70	19,75	19,82	19,91	19,71	19,70	19,91	19,75	19,75
200692_	1VK2D	30,00	30,00	30,00	30,00	31,00	30,00	30,00	31,00	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}
200692_	1VK2D	19,69	19,76	19,78	19,84	19,80	19,80	19,79	19,73	19,79	19,76
200692_	1VK2D	30,00	30,00	30,00	30,00	30,00	30,00	30,00	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}
200692_	1VK2D	19,85	19,83	19,74	19,81	19,83	19,87	19,88	19,73	19,76	19,73
200692_	1VK2D	30,00	30,00	30,00	30,00	31,00	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}
200692_	1VK2D	19,71	19,80	19,90	19,90	19,74	19,86	19,77	19,76	19,79	19,77
200692_	1VK2D	30,00	30,00	31,00	30,00	31,00	30,00	31,00	30,00	30,00	30,00

Machine Capability Study
Tool System

Plant	ATG Westhausen		Operator Name	Sünder	Date 02.02.2022

Ser.No.	756027_d	Characteristic			
Type	1BD-1B060A-1K2D-1VK2D	Char.Descr.	1VK2D	Inspection Val.	19,61
Ord. No.	1BD53T2O-A	Ser.No.	200692_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}
200692_	1VK2D	19,89	19,74	19,90	19,72	19,72	19,93	19,79	19,89	19,82	19,72
200692_	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}
200692_	1VK2D	19,76	19,78	19,72	19,82	19,74	19,78	19,78	19,71	19,74	19,72
200692_	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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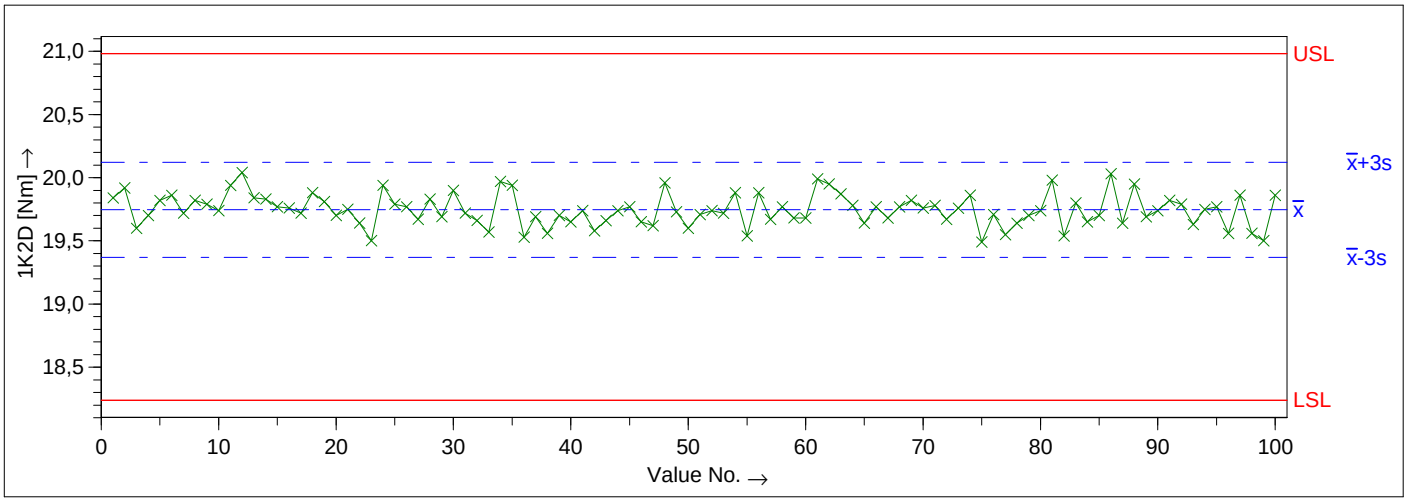
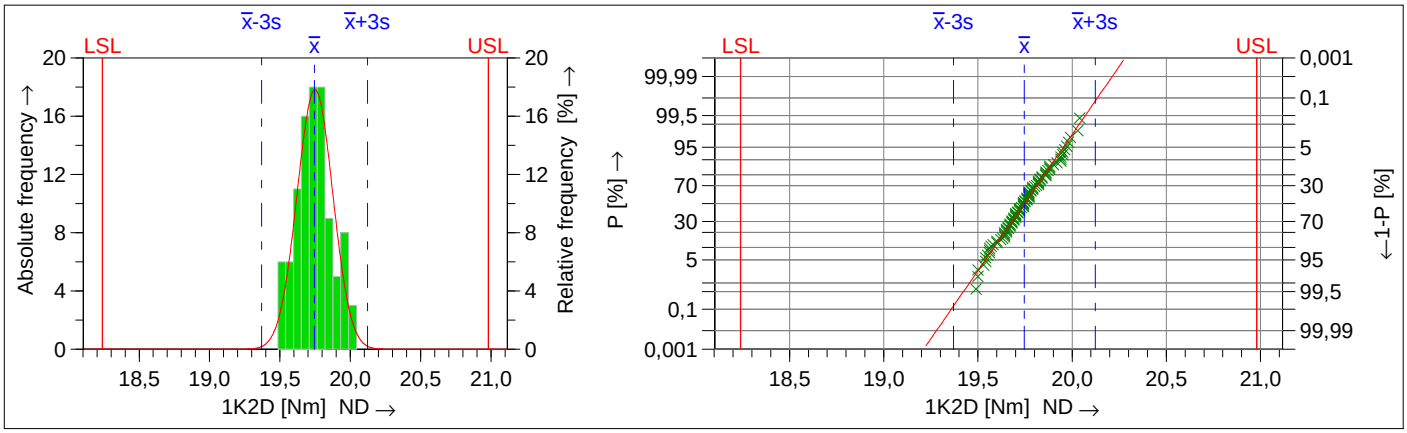
Plant	ATG Westhausen	Operator Name	Sünder
Date	02.02.2022		

Ord. No.	1BD53T2O-A	Part type	1BD-1B060A-1K2D-1VK2D	Contr.item	yes
Serial No.	756027_d	Char.Descr.	1K2D	Inspection Val. 19,61 1,37	USL 20,98
		Serial No.	202851	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 02.02.2022 08:44:28 to 02.02.2022 08:58:21

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			$\bar{x}$	19.7464
LSL	18.24	x_{min}	19.49	$\bar{x}$-3s	19.3702
USL	20.98	x_{max}	20.04	$\bar{x}$+3s	20.1226
T	2.74	R	0.55	6s	0.7523
		$n_{<T>}$	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	3.64
Critical capability index	=	C_{mk}	3.28

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

APEX VDI/VDE 2647 V0.1

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Machine Capability Study
Tool System

Plant	ATG Westhausen		Operator Name	Sünder	Date 02.02.2022

Ser.No.	756027_d	Characteristic			
Type	1BD-1B060A-1K2D-1VK2D	Char.Descr.	1K2D	Inspection Val.	19,61
Ord. No.	1BD53T2O-A	Ser.No.	202851	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}
202851	1K2D	19,84	19,92	19,60	19,70	19,82	19,86	19,72	19,82	19,79	19,74
202851	1K2D	31,00	31,00	31,00	31,00	31,00	31,00	31,00	30,00	31,00	31,00

Char.No	Char.Descr.	x_{11}	x_{12}	x_{13}	x_{14}	x_{15}	x_{16}	x_{17}	x_{18}	x_{19}	x_{20}
202851	1K2D	19,94	20,04	19,84	19,83	19,77	19,76	19,72	19,88	19,81	19,70
202851	1K2D	31,00	31,00	31,00	30,00	29,00	31,00	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}
202851	1K2D	19,75	19,64	19,50	19,94	19,79	19,77	19,67	19,83	19,69	19,90
202851	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_{31}	x_{32}	x_{33}	x_{34}	x_{35}	x_{36}	x_{37}	x_{38}	x_{39}	x_{40}
202851	1K2D	19,72	19,66	19,57	19,97	19,94	19,53	19,69	19,56	19,70	19,65
202851	1K2D	30,00	30,00	31,00	30,00	31,00	30,00	31,00	30,00	30,00	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}
202851	1K2D	19,74	19,58	19,66	19,74	19,77	19,65	19,62	19,96	19,73	19,60
202851	1K2D	30,00	30,00	30,00	30,00	31,00	30,00	30,00	31,00	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}
202851	1K2D	19,71	19,74	19,72	19,88	19,54	19,88	19,67	19,77	19,68	19,68
202851	1K2D	30,00	30,00	30,00	30,00	30,00	30,00	30,00	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}
202851	1K2D	19,99	19,95	19,87	19,78	19,64	19,77	19,68	19,77	19,82	19,76
202851	1K2D	30,00	30,00	30,00	30,00	31,00	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}
202851	1K2D	19,78	19,67	19,76	19,86	19,49	19,71	19,55	19,64	19,70	19,74
202851	1K2D	30,00	30,00	31,00	30,00	31,00	30,00	31,00	30,00	30,00	30,00

Machine Capability Study
Tool System

Plant	ATG Westhausen		Operator Name	Sünder	Date 02.02.2022

Ser.No.	756027_d	Characteristic			
Type	1BD-1B060A-1K2D-1VK2D	Char.Descr.	1K2D	Inspection Val.	19,61
Ord. No.	1BD53T2O-A	Ser.No.	202851	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}
202851	1K2D	19,98	19,54	19,80	19,65	19,70	20,03	19,64	19,95	19,69	19,74
202851	1K2D	30,00	30,00	30,00	30,00	30,00	30,00	30,00	30,00	30,00	30,00

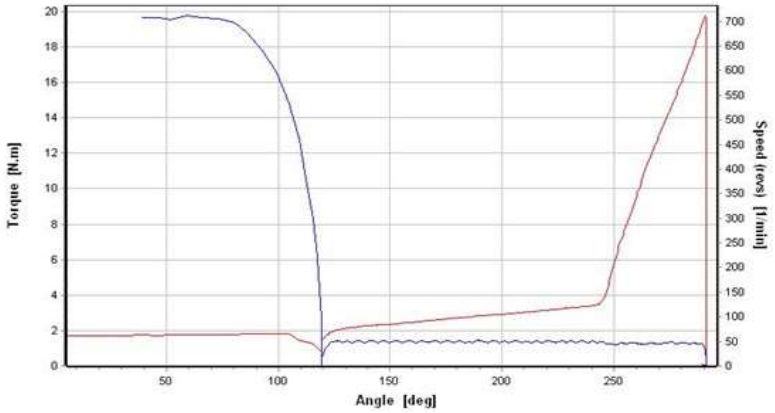
Char.No	Char.Descr.	x_{91}	x_{92}	x_{93}	x_{94}	x_{95}	x_{96}	x_{97}	x_{98}	x_{99}	x_{100}
202851	1K2D	19,82	19,79	19,63	19,75	19,77	19,56	19,86	19,56	19,50	19,86
202851	1K2D	30,00	30,00	30,00	30,00	30,00	30,00	30,00	30,00	30,00	30,00

Torque graphs

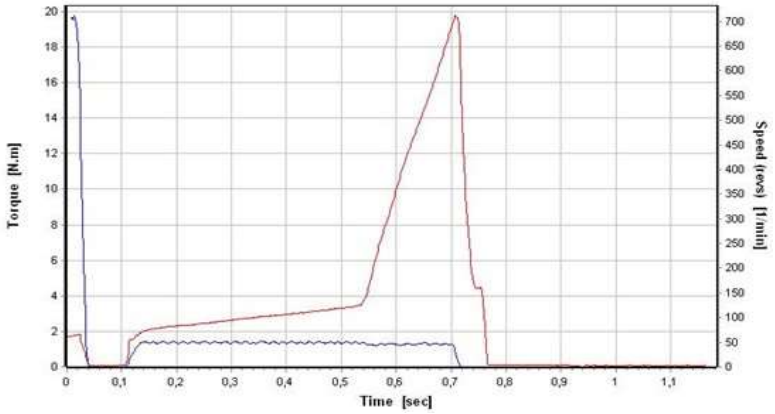
Machine Capability Study 30 %

Model: **1BD-1B060A-1K2D-1VK2D**
Serial no: **756027**

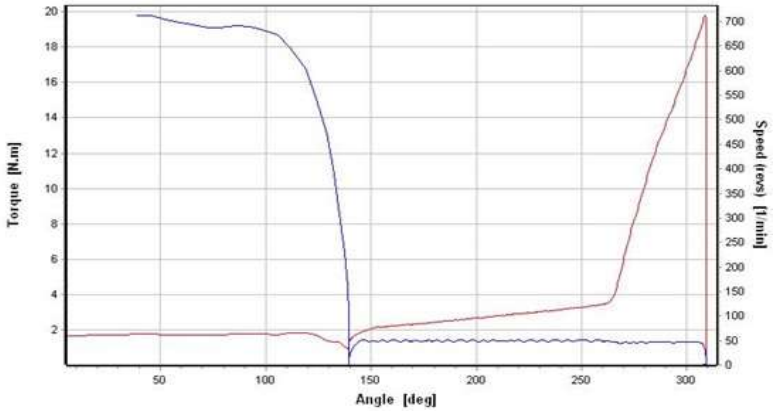
Angle degree: **30°**
Test torque: **19,6 Nm**



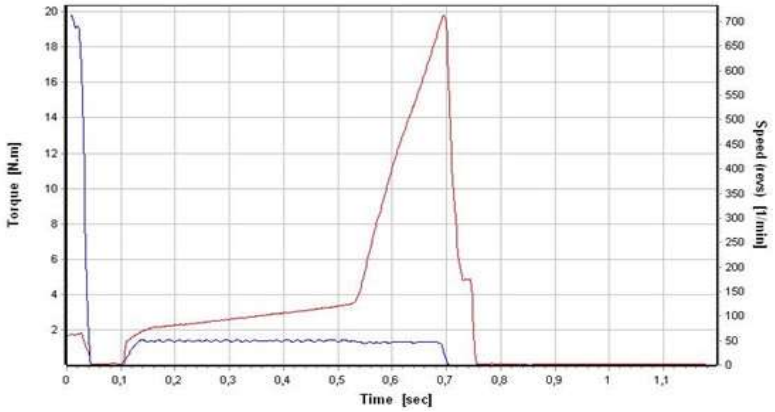
Value no. 1
Graph
Torque / Angle / Speed



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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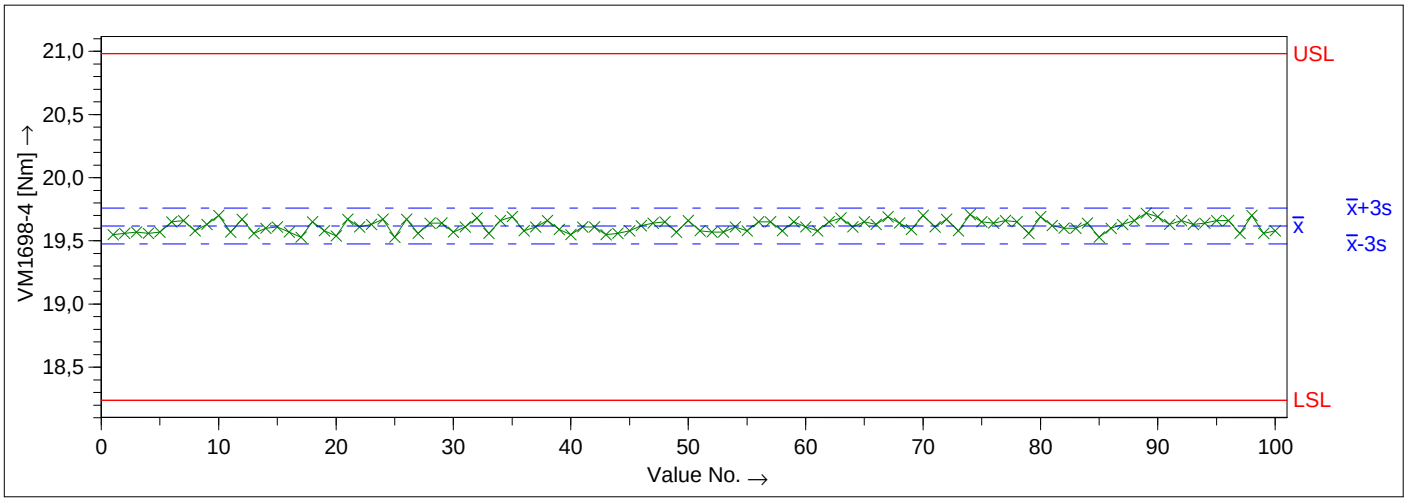
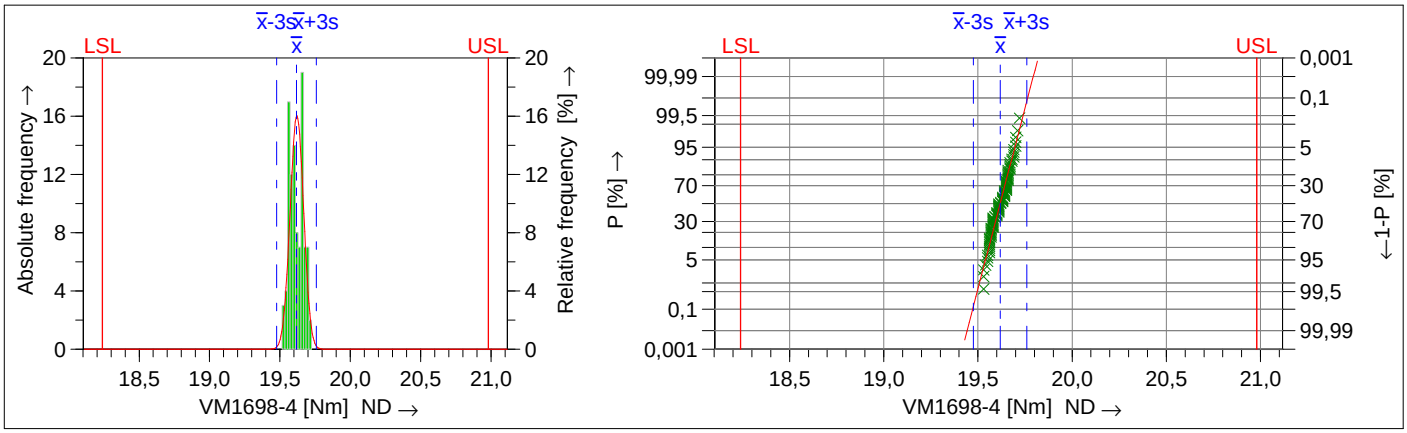
Plant	ATG Westhausen	Operator Name	Sünder
Date	02.02.2022		

Ord. No.	1BD53T2O-A	Part type	1BD-1B060A-1K2D-1VK2D	Contr.item	yes
Serial No.	756027_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 02.02.2022 09:01:32 to 02.02.2022 09:18:58

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			$\bar{x}$	19.6180
LSL	18.24	x_{min}	19.53	$\bar{x}$-3s	19.4762
USL	20.98	x_{max}	19.72	$\bar{x}$+3s	19.7598
T	2.74	R	0.19	6s	0.2836
		$n_{<T>}$	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	9.66
Critical capability index	=	C_{mk}	9.60

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

APEX VDI/VDE 2647 V0.1

Apex Tool Group GmbH \\htwe0006\AppData\QW\QWE\MessWert\2022\756027_cM.DFD

Machine Capability Study
Control System

Plant	ATG Westhausen		Operator Name	Sünder	Date 02.02.2022

Ser.No.	756027_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	19,55	19,56	19,57	19,56	19,57	19,65	19,66	19,58	19,63	19,70
1024210	VM1698-4	350,25	373,00	359,50	370,00	368,50	370,25	362,75	364,50	370,50	377,75

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	19,57	19,67	19,56	19,60	19,61	19,57	19,53	19,65	19,58	19,54
1024210	VM1698-4	377,00	372,50	368,75	368,50	356,25	365,25	362,75	364,75	371,50	369,25

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	19,67	19,61	19,63	19,67	19,53	19,67	19,56	19,64	19,64	19,57
1024210	VM1698-4	361,50	360,50	384,00	374,50	360,75	361,75	359,25	354,75	354,50	358,25

Char.No	Char.Descr.	x_{31}	x_{32}	x_{33}	x_{34}	x_{35}	x_{36}	x_{37}	x_{38}	x_{39}	x_{40}
1024210	VM1698-4	19,61	19,68	19,56	19,66	19,69	19,58	19,61	19,66	19,59	19,55
1024210	VM1698-4	360,00	358,50	366,00	357,00	357,75	360,50	368,50	363,50	363,75	371,50

Char.No	Char.Descr.	x_{41}	x_{42}	x_{43}	x_{44}	x_{45}	x_{46}	x_{47}	x_{48}	x_{49}	x_{50}
1024210	VM1698-4	19,61	19,61	19,55	19,56	19,58	19,62	19,64	19,65	19,57	19,66
1024210	VM1698-4	355,00	365,00	371,00	367,50	374,25	360,50	348,25	349,75	356,25	353,75

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	19,58	19,57	19,57	19,61	19,58	19,65	19,65	19,58	19,65	19,61
1024210	VM1698-4	356,00	361,75	361,25	356,75	363,50	358,25	364,25	355,50	358,00	361,75

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	19,58	19,65	19,68	19,61	19,65	19,63	19,69	19,64	19,59	19,70
1024210	VM1698-4	363,50	363,25	355,00	360,50	361,00	365,50	365,50	363,25	358,50	349,75

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	19,61	19,67	19,58	19,71	19,65	19,64	19,66	19,65	19,56	19,69
1024210	VM1698-4	363,75	360,00	368,25	361,75	364,75	364,00	364,25	365,50	365,00	360,75

Machine Capability Study
Control System

Plant	ATG Westhausen		Operator Name	Sünder	Date 02.02.2022

Ser.No.	756027_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	19,62	19,60	19,60	19,64	19,53	19,60	19,63	19,66	19,72	19,69
1024210	VM1698-4	359,50	362,75	363,50	364,75	363,00	360,75	358,50	359,25	362,25	359,75

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	19,63	19,66	19,63	19,64	19,66	19,66	19,56	19,70	19,56	19,58
1024210	VM1698-4	362,50	361,75	364,25	360,25	356,25	365,00	363,00	364,75	364,25	379,00

Machine Capability Study
Tool System

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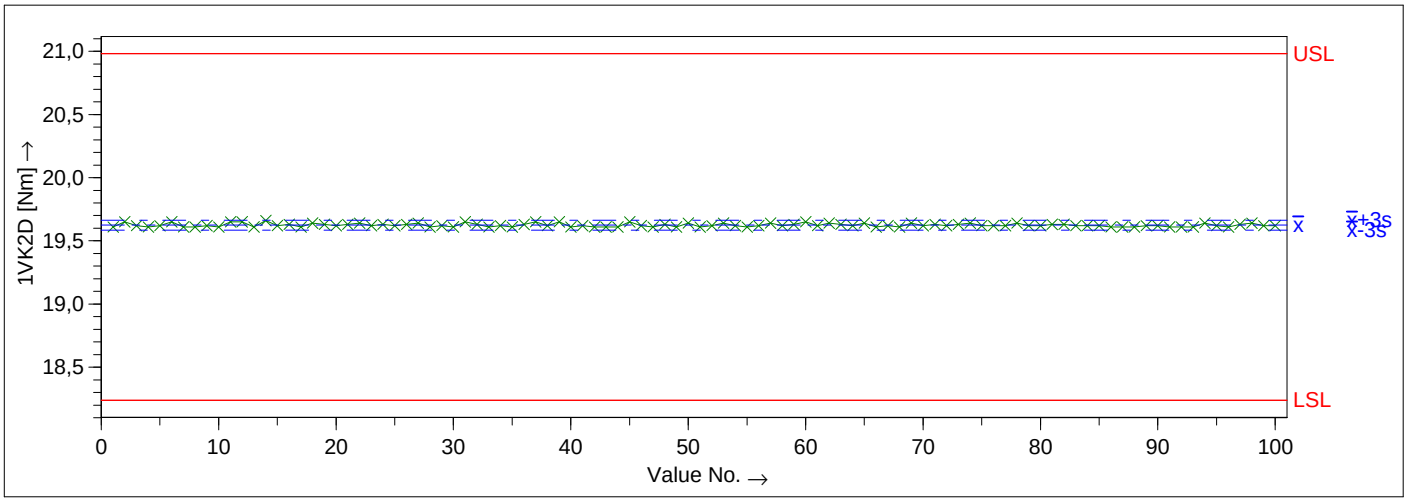
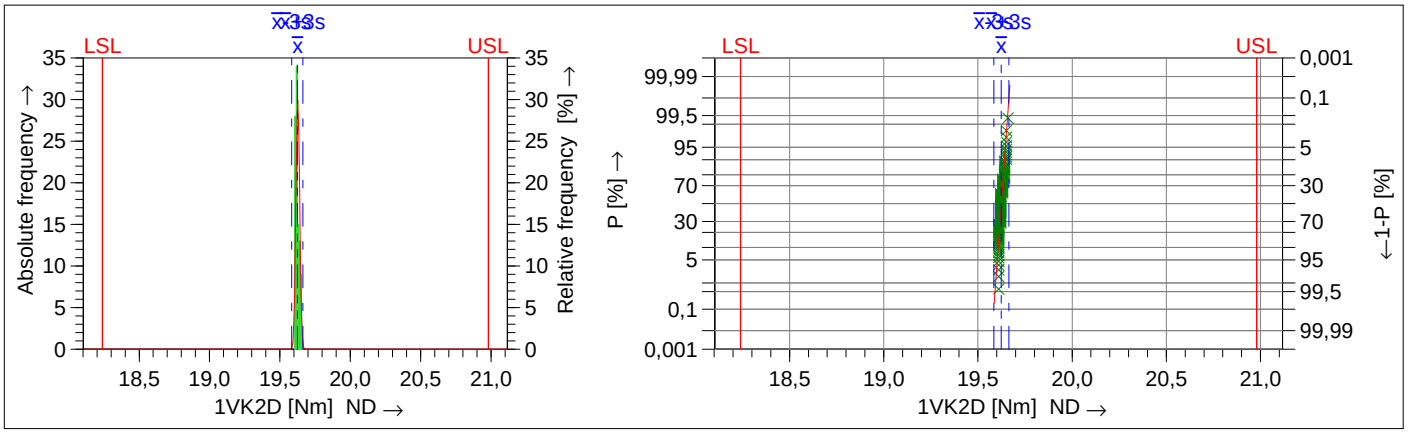
Plant	ATG Westhausen	Operator Name	Sünder
Date	02.02.2022		

Ord. No.	1BD53T2O-A	Part type	1BD-1B060A-1K2D-1VK2D	Contr.item	yes
Serial No.	756027_c	Char.Descr.	1VK2D	Inspection Val. 19,61 1,37	USL 20,98
		Serial No.	200692_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 02.02.2022 09:01:32 to 02.02.2022 09:18:59

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	19.5848
USL	20.98	x_{max}	19.66	$\bar{x}$+3s	19.6640
T	2.74	R	0.05	6s	0.0792
		$n_{<T>}$	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	34.58
Critical capability index	=	C_{mk}	34.22

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

APEX VDI/VDE 2647 V0.1

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Machine Capability Study
Tool System

Plant	ATG Westhausen		Operator Name	Sünder	Date 02.02.2022

Ser.No.	756027_c	Characteristic			
Type	1BD-1B060A-1K2D-1VK2D	Char.Descr.	1VK2D	Inspection Val.	19,61
Ord. No.	1BD53T2O-A	Ser.No.	200692_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}
200692_	1VK2D	19,61	19,65	19,62	19,61	19,62	19,65	19,61	19,61	19,62	19,61
200692_	1VK2D	352,00	373,00	360,00	371,00	368,00	368,00	360,00	365,00	369,00	375,00

Char.No	Char.Descr.	x_{11}	x_{12}	x_{13}	x_{14}	x_{15}	x_{16}	x_{17}	x_{18}	x_{19}	x_{20}
200692_	1VK2D	19,65	19,65	19,61	19,66	19,62	19,63	19,61	19,64	19,63	19,62
200692_	1VK2D	377,00	369,00	368,00	368,00	356,00	365,00	363,00	363,00	371,00	370,00

Char.No	Char.Descr.	x_{21}	x_{22}	x_{23}	x_{24}	x_{25}	x_{26}	x_{27}	x_{28}	x_{29}	x_{30}
200692_	1VK2D	19,63	19,64	19,62	19,63	19,62	19,63	19,64	19,61	19,62	19,61
200692_	1VK2D	358,00	360,00	383,00	371,00	361,00	360,00	359,00	353,00	353,00	357,00

Char.No	Char.Descr.	x_{31}	x_{32}	x_{33}	x_{34}	x_{35}	x_{36}	x_{37}	x_{38}	x_{39}	x_{40}
200692_	1VK2D	19,65	19,63	19,61	19,62	19,61	19,63	19,65	19,62	19,65	19,61
200692_	1VK2D	359,00	355,00	366,00	355,00	356,00	360,00	368,00	362,00	363,00	372,00

Char.No	Char.Descr.	x_{41}	x_{42}	x_{43}	x_{44}	x_{45}	x_{46}	x_{47}	x_{48}	x_{49}	x_{50}
200692_	1VK2D	19,62	19,61	19,61	19,61	19,65	19,62	19,61	19,63	19,61	19,64
200692_	1VK2D	354,00	363,00	370,00	367,00	374,00	359,00	346,00	348,00	356,00	350,00

Char.No	Char.Descr.	x_{51}	x_{52}	x_{53}	x_{54}	x_{55}	x_{56}	x_{57}	x_{58}	x_{59}	x_{60}
200692_	1VK2D	19,61	19,62	19,64	19,62	19,61	19,62	19,64	19,62	19,63	19,65
200692_	1VK2D	355,00	362,00	361,00	355,00	362,00	356,00	363,00	354,00	355,00	361,00

Char.No	Char.Descr.	x_{61}	x_{62}	x_{63}	x_{64}	x_{65}	x_{66}	x_{67}	x_{68}	x_{69}	x_{70}
200692_	1VK2D	19,62	19,64	19,63	19,62	19,64	19,61	19,62	19,61	19,64	19,62
200692_	1VK2D	363,00	361,00	353,00	360,00	360,00	364,00	361,00	362,00	357,00	348,00

Char.No	Char.Descr.	x_{71}	x_{72}	x_{73}	x_{74}	x_{75}	x_{76}	x_{77}	x_{78}	x_{79}	x_{80}
200692_	1VK2D	19,63	19,62	19,63	19,64	19,62	19,62	19,62	19,64	19,62	19,62
200692_	1VK2D	363,00	358,00	368,00	359,00	363,00	362,00	363,00	363,00	364,00	358,00

Machine Capability Study
Tool System

Plant	ATG Westhausen		Operator Name	Sünder	Date 02.02.2022

Ser.No.	756027_c	Characteristic			
Type	1BD-1B060A-1K2D-1VK2D	Char.Descr.	1VK2D	Inspection Val.	19,61
Ord. No.	1BD53T2O-A	Ser.No.	200692_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}
200692_	1VK2D	19,63	19,63	19,62	19,62	19,62	19,61	19,61	19,61	19,62	19,62
200692_	1VK2D	359,00	362,00	362,00	362,00	362,00	360,00	357,00	355,00	359,00	356,00

Char.No	Char.Descr.	x_{91}	x_{92}	x_{93}	x_{94}	x_{95}	x_{96}	x_{97}	x_{98}	x_{99}	x_{100}
200692_	1VK2D	19,61	19,61	19,61	19,64	19,62	19,61	19,63	19,64	19,62	19,62
200692_	1VK2D	361,00	358,00	363,00	360,00	354,00	362,00	363,00	362,00	364,00	379,00

Machine Capability Study
Tool System

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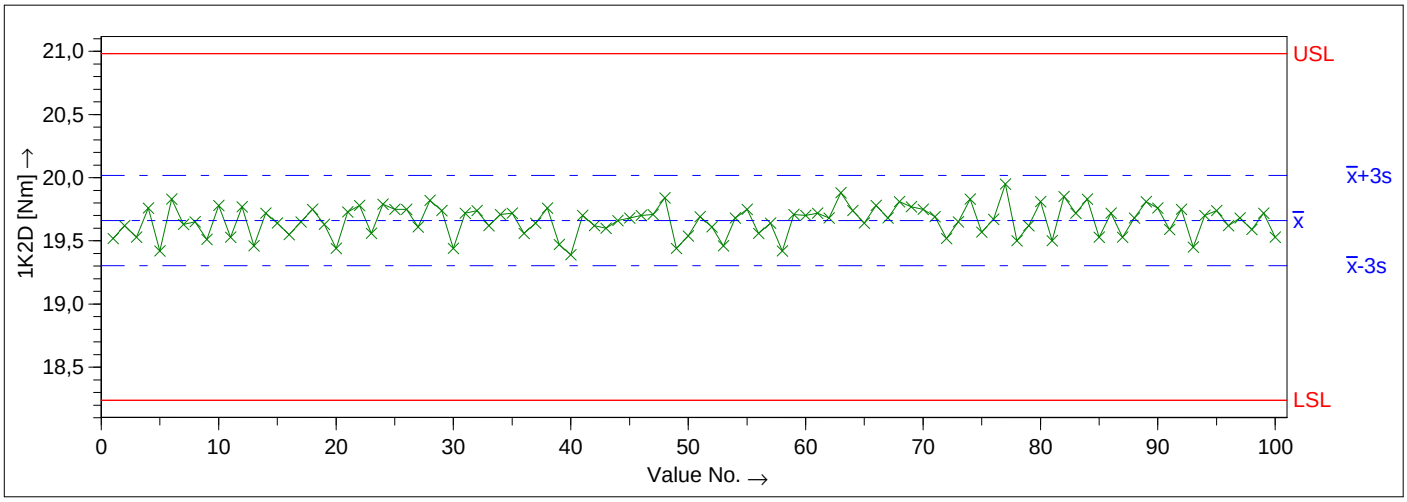
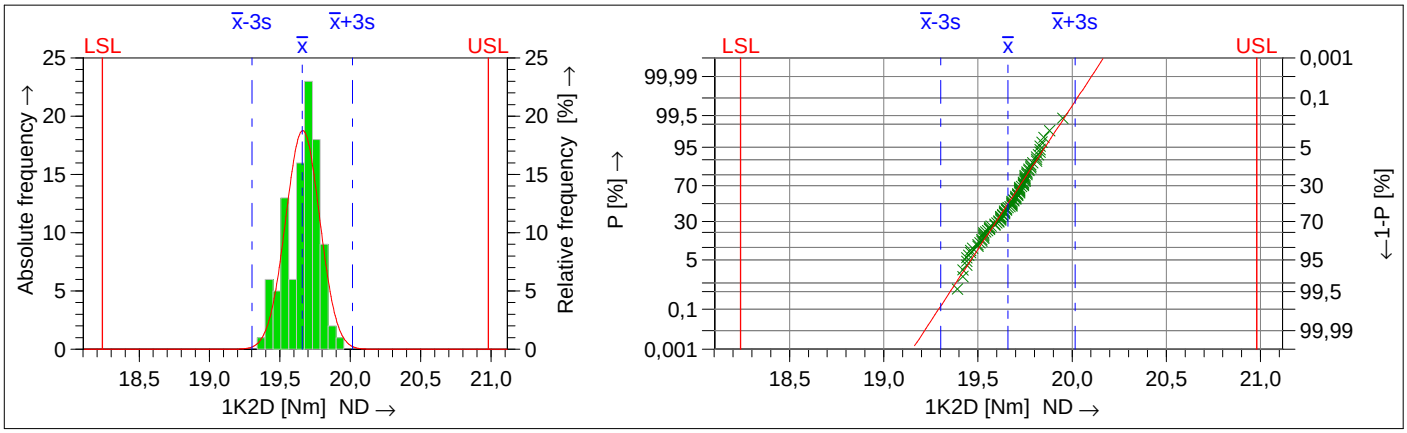
Plant	ATG Westhausen	Operator Name	Sünder
Date	02.02.2022		

Ord. No.	1BD53T2O-A	Part type	1BD-1B060A-1K2D-1VK2D	Contr.item	yes
Serial No.	756027_c	Char.Descr.	1K2D	Inspection Val.	19,61 / 1,37
		Serial No.	202851	Unit	Nm / -1,37
				USL	20,98
				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 02.02.2022 09:01:32 to 02.02.2022 09:18:59

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			$\bar{x}$	19.6596
LSL	18.24	x_{min}	19.39	$\bar{x}$-3s	19.3024
USL	20.98	x_{max}	19.95	$\bar{x}$+3s	20.0168
T	2.74	R	0.56	6s	0.7143
		$n_{<T>}$	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	3.84
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 02.02.2022

Ser.No.	756027_c	Characteristic			
Type	1BD-1B060A-1K2D-1VK2D	Char.Descr.	1K2D	Inspection Val.	19,61
Ord. No.	1BD53T2O-A	Ser.No.	202851	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}
202851	1K2D	19,52	19,62	19,53	19,76	19,42	19,83	19,63	19,65	19,51	19,78
202851	1K2D	352,00	373,00	360,00	371,00	368,00	368,00	360,00	365,00	369,00	375,00

Char.No	Char.Descr.	x_{11}	x_{12}	x_{13}	x_{14}	x_{15}	x_{16}	x_{17}	x_{18}	x_{19}	x_{20}
202851	1K2D	19,53	19,77	19,46	19,72	19,64	19,55	19,65	19,75	19,63	19,44
202851	1K2D	377,00	369,00	368,00	368,00	356,00	365,00	363,00	363,00	371,00	370,00

Char.No	Char.Descr.	x_{21}	x_{22}	x_{23}	x_{24}	x_{25}	x_{26}	x_{27}	x_{28}	x_{29}	x_{30}
202851	1K2D	19,73	19,78	19,56	19,79	19,75	19,75	19,61	19,82	19,74	19,44
202851	1K2D	358,00	360,00	383,00	371,00	361,00	360,00	359,00	353,00	353,00	357,00

Char.No	Char.Descr.	x_{31}	x_{32}	x_{33}	x_{34}	x_{35}	x_{36}	x_{37}	x_{38}	x_{39}	x_{40}
202851	1K2D	19,72	19,74	19,62	19,71	19,72	19,56	19,64	19,76	19,47	19,39
202851	1K2D	359,00	355,00	366,00	355,00	356,00	360,00	368,00	362,00	363,00	372,00

Char.No	Char.Descr.	x_{41}	x_{42}	x_{43}	x_{44}	x_{45}	x_{46}	x_{47}	x_{48}	x_{49}	x_{50}
202851	1K2D	19,70	19,62	19,60	19,66	19,68	19,70	19,71	19,84	19,44	19,54
202851	1K2D	354,00	363,00	370,00	367,00	374,00	359,00	346,00	348,00	356,00	350,00

Char.No	Char.Descr.	x_{51}	x_{52}	x_{53}	x_{54}	x_{55}	x_{56}	x_{57}	x_{58}	x_{59}	x_{60}
202851	1K2D	19,69	19,61	19,46	19,68	19,75	19,56	19,64	19,42	19,71	19,70
202851	1K2D	355,00	362,00	361,00	355,00	362,00	356,00	363,00	354,00	355,00	361,00

Char.No	Char.Descr.	x_{61}	x_{62}	x_{63}	x_{64}	x_{65}	x_{66}	x_{67}	x_{68}	x_{69}	x_{70}
202851	1K2D	19,72	19,68	19,88	19,74	19,64	19,78	19,68	19,81	19,77	19,75
202851	1K2D	363,00	361,00	353,00	360,00	360,00	364,00	361,00	362,00	357,00	348,00

Char.No	Char.Descr.	x_{71}	x_{72}	x_{73}	x_{74}	x_{75}	x_{76}	x_{77}	x_{78}	x_{79}	x_{80}
202851	1K2D	19,69	19,52	19,65	19,83	19,57	19,67	19,95	19,50	19,62	19,81
202851	1K2D	363,00	358,00	368,00	359,00	363,00	362,00	363,00	363,00	364,00	358,00

Machine Capability Study
Tool System

Plant	ATG Westhausen		Operator Name	Sünder	Date 02.02.2022

Ser.No.	756027_c	Characteristic			
Type	1BD-1B060A-1K2D-1VK2D	Char.Descr.	1K2D	Inspection Val.	19,61
Ord. No.	1BD53T2O-A	Ser.No.	202851	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}
202851	1K2D	19,50	19,85	19,72	19,83	19,53	19,72	19,53	19,68	19,81	19,76
202851	1K2D	359,00	362,00	362,00	362,00	362,00	360,00	357,00	355,00	359,00	356,00

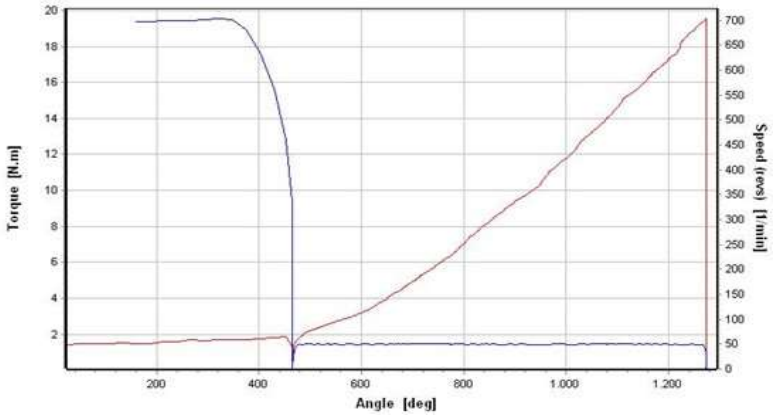
Char.No	Char.Descr.	x_{91}	x_{92}	x_{93}	x_{94}	x_{95}	x_{96}	x_{97}	x_{98}	x_{99}	x_{100}
202851	1K2D	19,59	19,75	19,45	19,70	19,74	19,62	19,68	19,59	19,72	19,53
202851	1K2D	361,00	358,00	363,00	360,00	354,00	362,00	363,00	362,00	364,00	379,00

Torque graphs

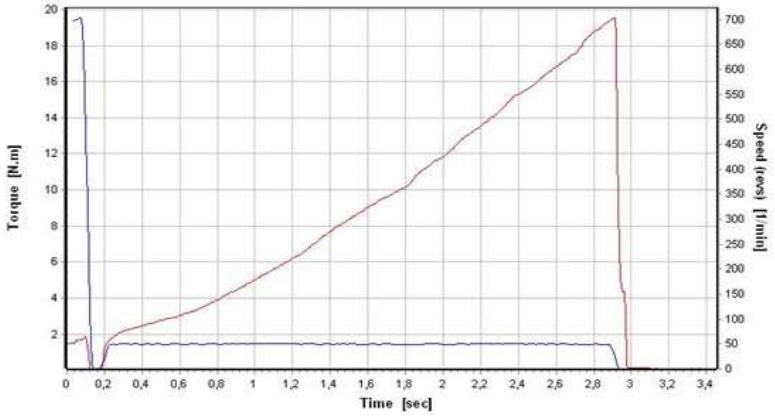
Machine Capability Study 30 %

Model: **1BD-1B060A-1K2D-1VK2D**
Serial no: **756027**

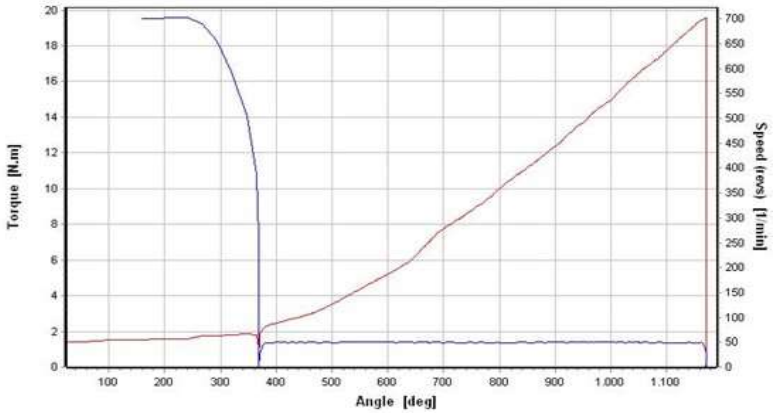
Angle degree: **360°**
Test torque: **19,6 Nm**



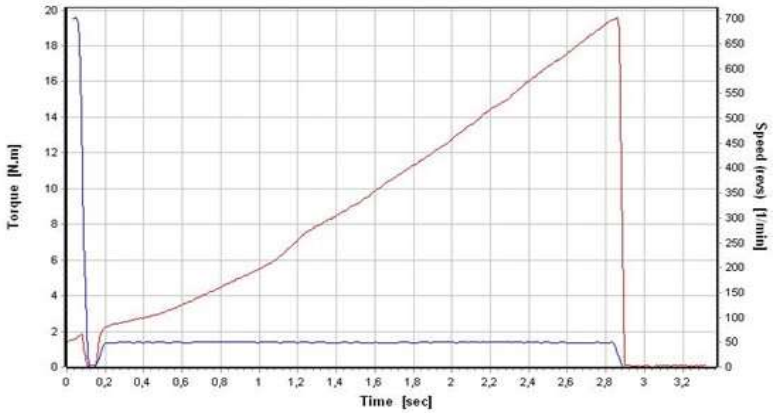
Value no. 1
Graph
Torque / Angle / Speed



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: **756027**

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

Hard joint (H)	262,64	Nm / Revolution	Angle degree	30°
Soft joint (L)	21,75	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	43,77	43,51 Nm
	Standard deviation	0,06	0,07 Nm
	Torque scatter (99,73%)	0,35	0,42 Nm
	C_m	17,23	14,36
	C_{mk}	15,45	14,14

b)	Min. C_m hard/soft (lowest value)	14,36
	Min. C_{mk} hard/soft (lowest value)	14,14

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

Note:

Machine Capability Study
Control System

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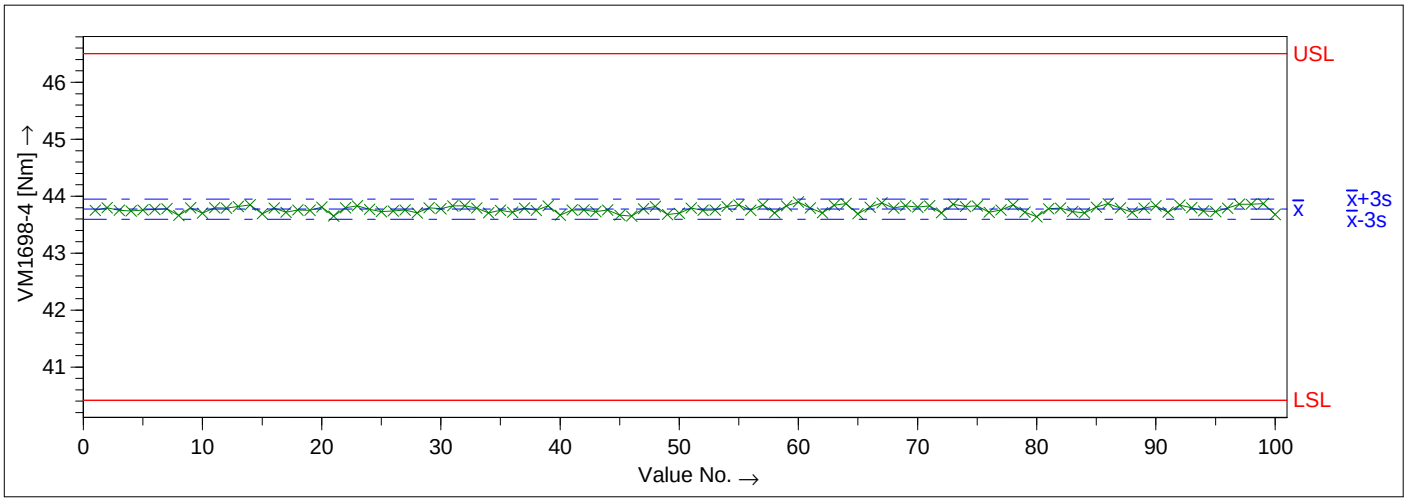
Plant ATG Westhausen		Operator Name Sünder	Date 02.02.2022

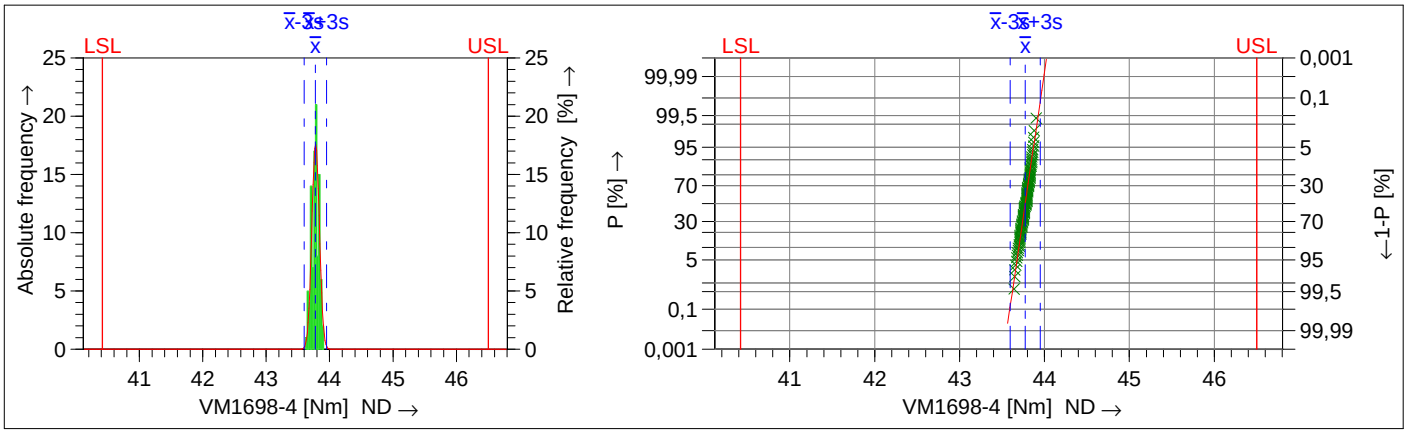
Ord. No. 1BD53T2O-A	Part type 1BD-1B060A-1K2D-1VK2D				Contr.item yes
Serial No. 756027_h	Char.Descr. VM1698-4	Inspection Val. 43,46	3,04	USL 46,50	
	Serial No. 1024210	Unit Nm	-3,04	LSL 40,42	
Char.Type variable		Tolerance value 7 %		Decimal Pl. 2	

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

Evaluation from 02.02.2022 08:24:54 to 02.02.2022 08:40:23

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			$\bar{x}$	43.7732
LSL	40.42	x_{min}	43.64	$\bar{x}$-3s	43.5967
USL	46.50	x_{max}	43.90	$\bar{x}$+3s	43.9497
T	6.08	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	17.23
Critical capability index	=	C_{mk}	15.45

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 02.02.2022

Ser.No.	756027_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	43,75	43,80	43,75	43,74	43,76	43,77	43,78	43,66	43,80	43,70
1024210	VM1698-4	30,00	30,25	30,25	30,00	30,25	30,25	30,25	30,00	30,50	30,25

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	43,80	43,79	43,82	43,85	43,69	43,79	43,72	43,76	43,75	43,81
1024210	VM1698-4	30,00	30,00	30,00	30,50	30,00	30,25	30,25	30,00	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	43,65	43,80	43,83	43,77	43,73	43,74	43,76	43,71	43,80	43,78
1024210	VM1698-4	29,75	30,25	30,50	30,25	30,25	30,25	30,25	30,25	30,00	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	43,83	43,83	43,79	43,71	43,75	43,72	43,79	43,75	43,83	43,67
1024210	VM1698-4	30,25	30,25	30,25	30,50	30,25	30,50	30,00	30,00	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	43,76	43,76	43,73	43,76	43,67	43,65	43,78	43,82	43,68	43,70
1024210	VM1698-4	30,25	30,25	30,00	30,00	30,25	30,25	30,50	27,75	30,00	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	43,79	43,75	43,76	43,82	43,85	43,75	43,85	43,71	43,83	43,90
1024210	VM1698-4	30,25	30,25	30,25	30,25	30,25	30,50	30,75	30,25	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	43,79	43,71	43,84	43,87	43,69	43,81	43,88	43,79	43,83	43,81
1024210	VM1698-4	30,25	30,25	30,50	30,50	30,25	30,50	30,50	30,50	30,50	30,25

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	43,83	43,71	43,86	43,82	43,83	43,72	43,76	43,85	43,72	43,64
1024210	VM1698-4	30,50	30,25	30,75	27,75	30,50	30,50	30,75	30,50	30,50	30,25

Machine Capability Study
Control System

Plant	ATG Westhausen		Operator Name	Sünder	Date 02.02.2022

Ser.No.	756027_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	43,78	43,79	43,73	43,71	43,81	43,87	43,79	43,72	43,79	43,83
1024210	VM1698-4	30,75	30,50	30,50	30,50	30,50	30,50	30,75	30,75	30,50	30,50

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	43,72	43,84	43,80	43,74	43,73	43,79	43,86	43,86	43,87	43,68
1024210	VM1698-4	30,75	30,50	30,50	30,25	30,50	30,75	30,75	30,50	30,50	30,75

Machine Capability Study
Tool System

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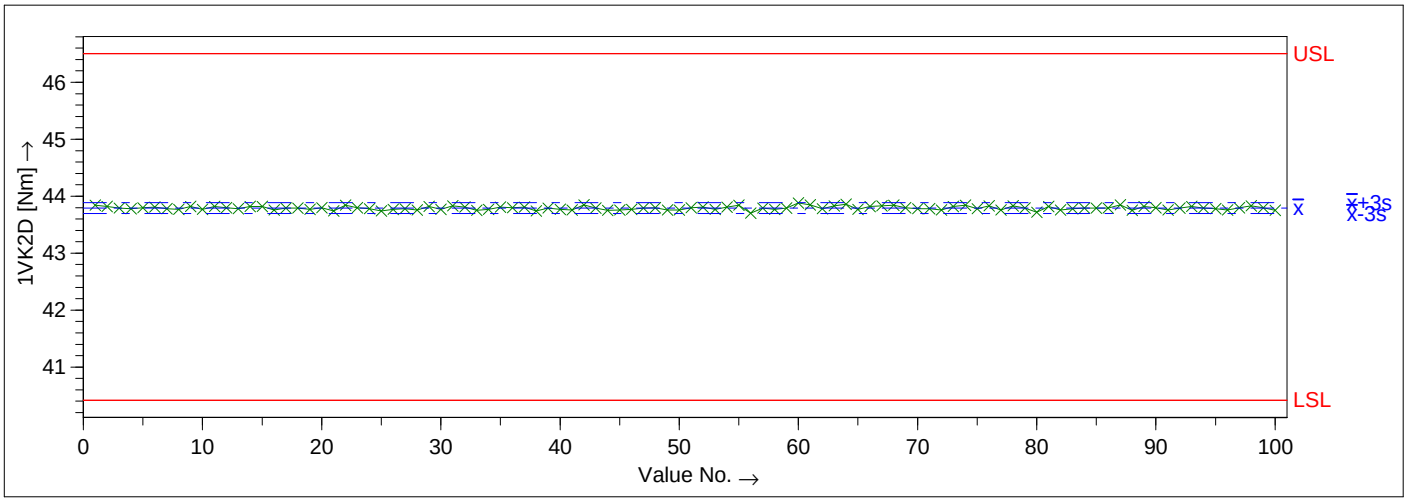
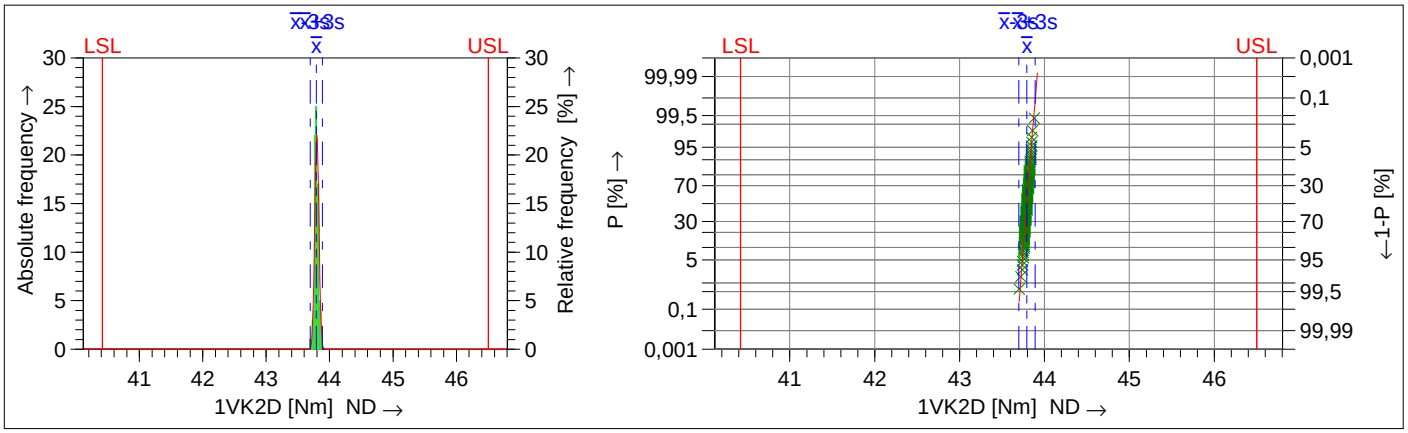
Plant	ATG Westhausen	Operator Name	Sünder
Date	02.02.2022		

Ord. No.	1BD53T2O-A	Part type	1BD-1B060A-1K2D-1VK2D	Contr.item	yes
Serial No.	756027_h	Char.Descr.	1VK2D	Inspection Val. 43,46 3,04	USL 46,50
		Serial No.	200692_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 02.02.2022 08:24:54 to 02.02.2022 08:40:24

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			$\bar{x}$	43.7926
LSL	40.42	x_{min}	43.70	$\bar{x}$-3s	43.6968
USL	46.50	x_{max}	43.88	$\bar{x}$+3s	43.8884
T	6.08	R	0.18	6s	0.1916
		$n_{<T>}$	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	31.74
Critical capability index	=	C_{mk}	28.27

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 02.02.2022

Ser.No.	756027_h	Characteristic			
Type	1BD-1B060A-1K2D-1VK2D	Char.Descr.	1VK2D	Inspection Val.	43,46
Ord. No.	1BD53T2O-A	Ser.No.	200692_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}
200692_	1VK2D	43,84	43,82	43,79	43,78	43,80	43,81	43,78	43,77	43,82	43,77
200692_	1VK2D	30,00	30,00	30,00	30,00	30,00	31,00	30,00	30,00	30,00	30,00

Char.No	Char.Descr.	x_{11}	x_{12}	x_{13}	x_{14}	x_{15}	x_{16}	x_{17}	x_{18}	x_{19}	x_{20}
200692_	1VK2D	43,82	43,80	43,78	43,82	43,82	43,76	43,79	43,79	43,77	43,80
200692_	1VK2D	30,00	30,00	30,00	30,00	31,00	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}
200692_	1VK2D	43,74	43,84	43,80	43,78	43,74	43,77	43,78	43,76	43,82	43,77
200692_	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_{31}	x_{32}	x_{33}	x_{34}	x_{35}	x_{36}	x_{37}	x_{38}	x_{39}	x_{40}
200692_	1VK2D	43,83	43,81	43,75	43,77	43,81	43,80	43,81	43,74	43,79	43,77
200692_	1VK2D	30,00	30,00	30,00	31,00	30,00	30,00	30,00	30,00	30,00	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}
200692_	1VK2D	43,76	43,85	43,79	43,75	43,76	43,77	43,79	43,80	43,76	43,76
200692_	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}
200692_	1VK2D	43,80	43,81	43,77	43,81	43,84	43,70	43,79	43,77	43,79	43,88
200692_	1VK2D	30,00	30,00	30,00	30,00	30,00	30,00	30,00	31,00	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}
200692_	1VK2D	43,85	43,78	43,83	43,86	43,77	43,82	43,83	43,84	43,80	43,78
200692_	1VK2D	30,00	31,00	30,00	30,00	30,00	30,00	30,00	31,00	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}
200692_	1VK2D	43,78	43,76	43,82	43,84	43,78	43,83	43,76	43,83	43,79	43,72
200692_	1VK2D	30,00	30,00	30,00	30,00	30,00	31,00	30,00	30,00	31,00	31,00

Machine Capability Study
Tool System

Plant	ATG Westhausen		Operator Name	Sünder	Date 02.02.2022

Ser.No.	756027_h	Characteristic			
Type	1BD-1B060A-1K2D-1VK2D	Char.Descr.	1VK2D	Inspection Val.	43,46
Ord. No.	1BD53T2O-A	Ser.No.	200692_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}
200692_	1VK2D	43,82	43,76	43,78	43,79	43,79	43,79	43,85	43,75	43,82	43,80
200692_	1VK2D	30,00	30,00	30,00	30,00	30,00	30,00	31,00	31,00	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}
200692_	1VK2D	43,76	43,79	43,82	43,79	43,78	43,76	43,80	43,83	43,80	43,75
200692_	1VK2D	31,00	30,00	30,00	31,00	31,00	30,00	30,00	30,00	30,00	31,00

Machine Capability Study
Tool System

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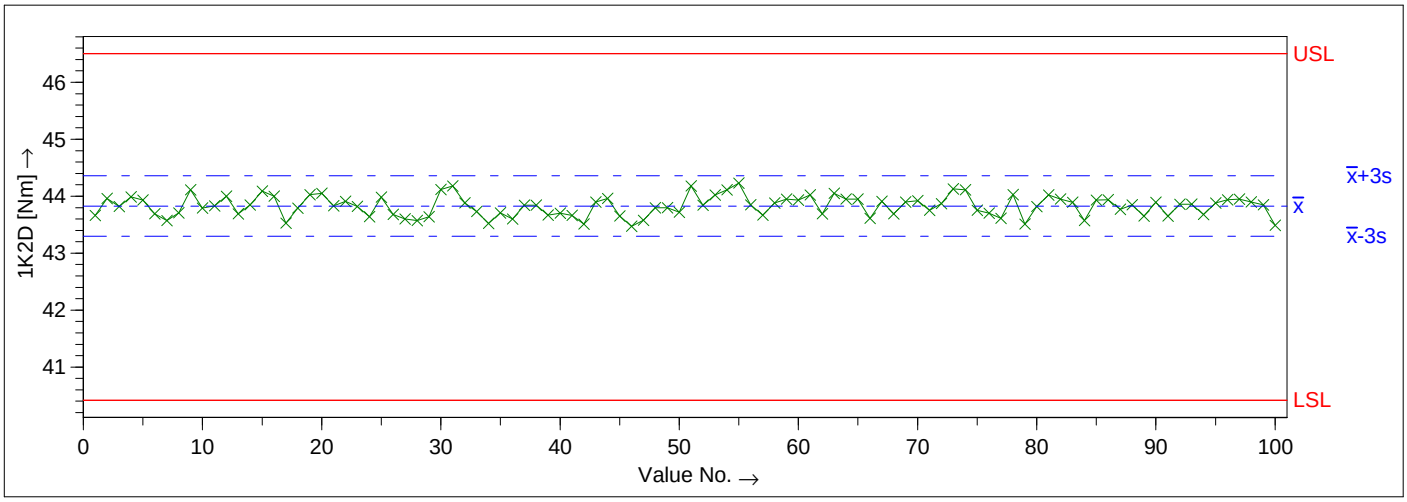
Plant	ATG Westhausen	Operator Name	Sünder
Date	02.02.2022		

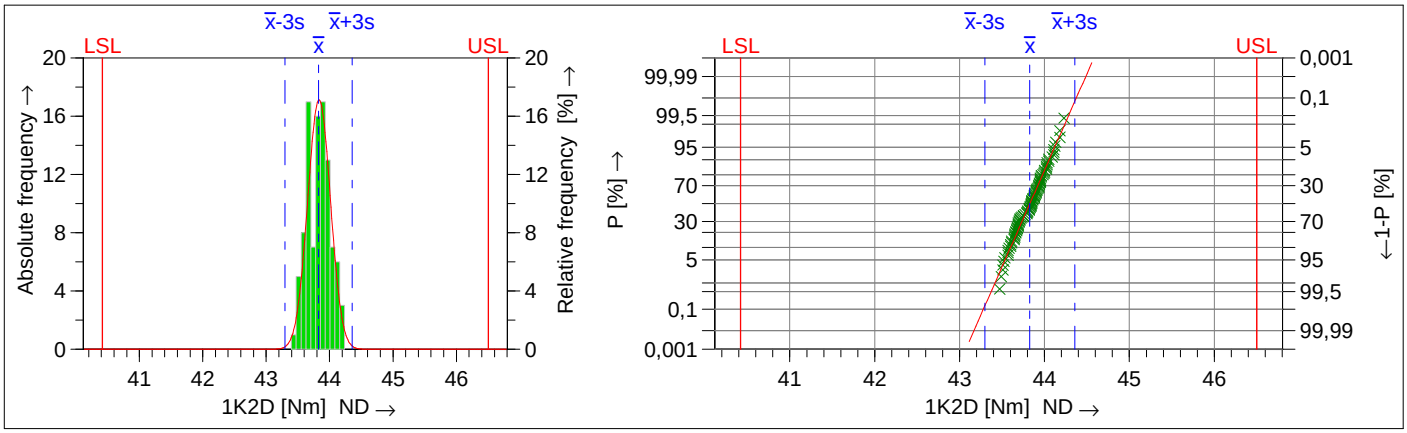
Ord. No.	1BD53T2O-A	Part type	1BD-1B060A-1K2D-1VK2D	Contr.item	yes
Serial No.	756027_h	Char.Descr.	1K2D	Inspection Val. 43,46 3,04	USL 46,50
		Serial No.	202851	Unit Nm -3,04	LSL 40,42
Char.Type	variable			Tolerance value 7 %	Decimal Pl. 2

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

Evaluation from 02.02.2022 08:24:54 to 02.02.2022 08:40:24

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			$\bar{x}$	43.8275
LSL	40.42	x_{min}	43.47	$\bar{x}$-3s	43.2966
USL	46.50	x_{max}	44.23	$\bar{x}$+3s	44.3584
T	6.08	R	0.76	6s	1.0617
		$n_{<T>}$	100	$p_{<T>}$	100.00000 %
		$n_{>USL}$	0	$p_{>USL}$	0.00000%
		$n_{<LSL}$	0	$p_{<LSL}$	0.00000%
		n_{eff}	100		
		n_{tot}	100		

Model distribution			Normal Distribution
Calculation method			$M1_{1,4}$ $\hat{\sigma} = s_{tot}$
Potential Capability index	=	C_m	5.73
Critical capability index	=	C_{mk}	5.03

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

APEX VDI/VDE 2647 V0.1

Apex Tool Group GmbH \\htwe0006\AppData\QW\QWE\MessWert\2022\756027_h2.DFD

Machine Capability Study
Tool System

Plant	ATG Westhausen		Operator Name	Sünder	Date 02.02.2022

Ser.No.	756027_h	Characteristic			
Type	1BD-1B060A-1K2D-1VK2D	Char.Descr.	1K2D	Inspection Val.	43,46
Ord. No.	1BD53T2O-A	Ser.No.	202851	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}
202851	1K2D	43,66	43,96	43,82	43,99	43,93	43,69	43,57	43,71	44,11	43,79
202851	1K2D	30,00	30,00	30,00	30,00	30,00	31,00	30,00	30,00	30,00	30,00

Char.No	Char.Descr.	x_{11}	x_{12}	x_{13}	x_{14}	x_{15}	x_{16}	x_{17}	x_{18}	x_{19}	x_{20}
202851	1K2D	43,83	44,00	43,69	43,85	44,09	44,00	43,53	43,79	44,03	44,05
202851	1K2D	30,00	30,00	30,00	30,00	31,00	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}
202851	1K2D	43,83	43,91	43,82	43,64	43,98	43,68	43,60	43,57	43,64	44,12
202851	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_{31}	x_{32}	x_{33}	x_{34}	x_{35}	x_{36}	x_{37}	x_{38}	x_{39}	x_{40}
202851	1K2D	44,18	43,88	43,73	43,52	43,71	43,60	43,84	43,84	43,67	43,70
202851	1K2D	30,00	30,00	30,00	31,00	30,00	30,00	30,00	30,00	30,00	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}
202851	1K2D	43,66	43,51	43,90	43,96	43,65	43,47	43,58	43,80	43,80	43,72
202851	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}
202851	1K2D	44,18	43,84	44,02	44,11	44,23	43,85	43,67	43,88	43,95	43,93
202851	1K2D	30,00	30,00	30,00	30,00	30,00	30,00	30,00	31,00	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}
202851	1K2D	44,02	43,69	44,05	43,95	43,95	43,61	43,91	43,69	43,90	43,92
202851	1K2D	30,00	31,00	30,00	30,00	30,00	30,00	30,00	31,00	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}
202851	1K2D	43,75	43,87	44,13	44,11	43,75	43,70	43,61	44,03	43,51	43,82
202851	1K2D	30,00	30,00	30,00	30,00	30,00	31,00	30,00	30,00	31,00	31,00

Machine Capability Study
Tool System

Plant	ATG Westhausen		Operator Name	Sünder	Date 02.02.2022

Ser.No.	756027_h	Characteristic			
Type	1BD-1B060A-1K2D-1VK2D	Char.Descr.	1K2D	Inspection Val.	43,46
Ord. No.	1BD53T2O-A	Ser.No.	202851	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}
202851	1K2D	44,02	43,95	43,89	43,57	43,93	43,94	43,77	43,85	43,65	43,89
202851	1K2D	30,00	30,00	30,00	30,00	30,00	30,00	31,00	31,00	30,00	30,00

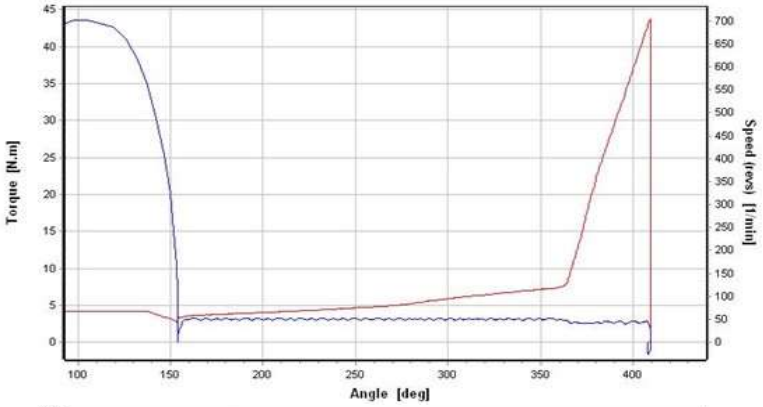
Char.No	Char.Descr.	x_{91}	x_{92}	x_{93}	x_{94}	x_{95}	x_{96}	x_{97}	x_{98}	x_{99}	x_{100}
202851	1K2D	43,65	43,86	43,86	43,68	43,88	43,94	43,95	43,90	43,85	43,49
202851	1K2D	31,00	30,00	30,00	31,00	31,00	30,00	30,00	30,00	30,00	31,00

Torque graphs

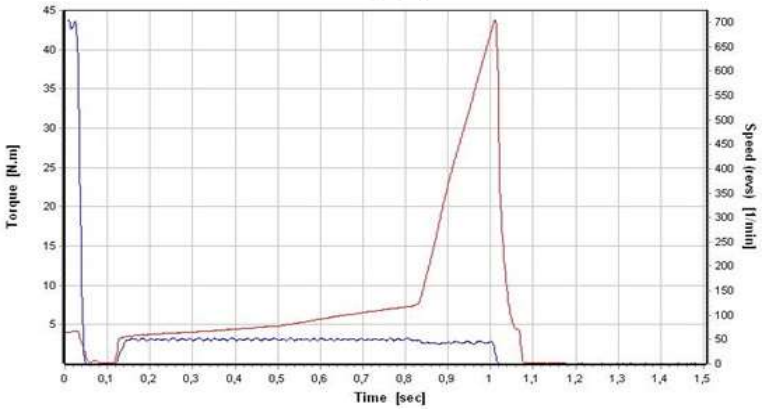
Machine Capability Study 80 %

Model: **1BD-1B060A-1K2D-1VK2D**
Serial no: **756027**

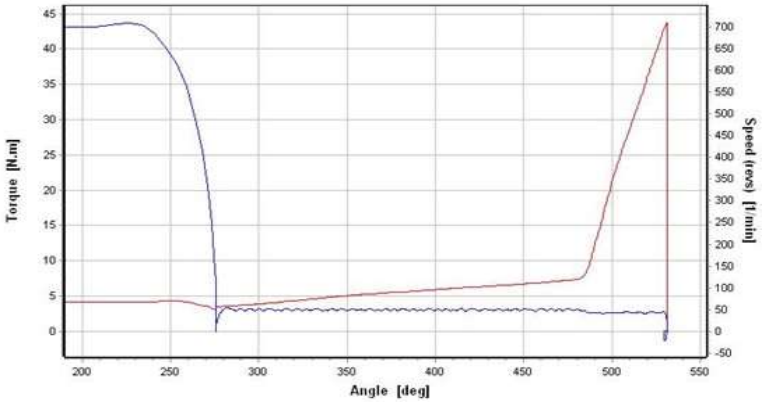
Angle degree: **30°**
Test torque: **43,5 Nm**



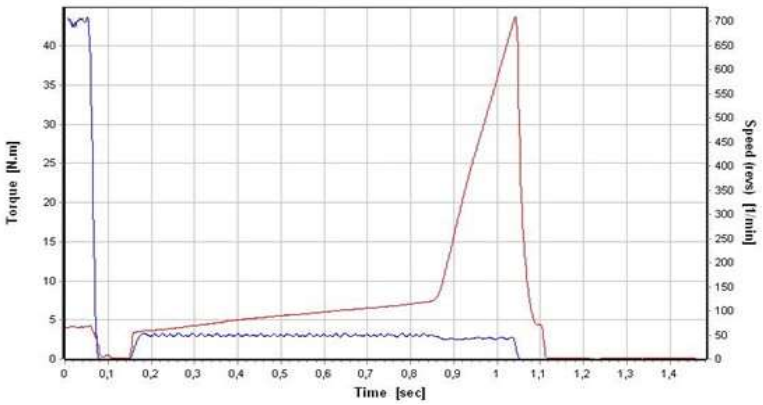
Value no. 1
Graph
Torque / Angle / Speed



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

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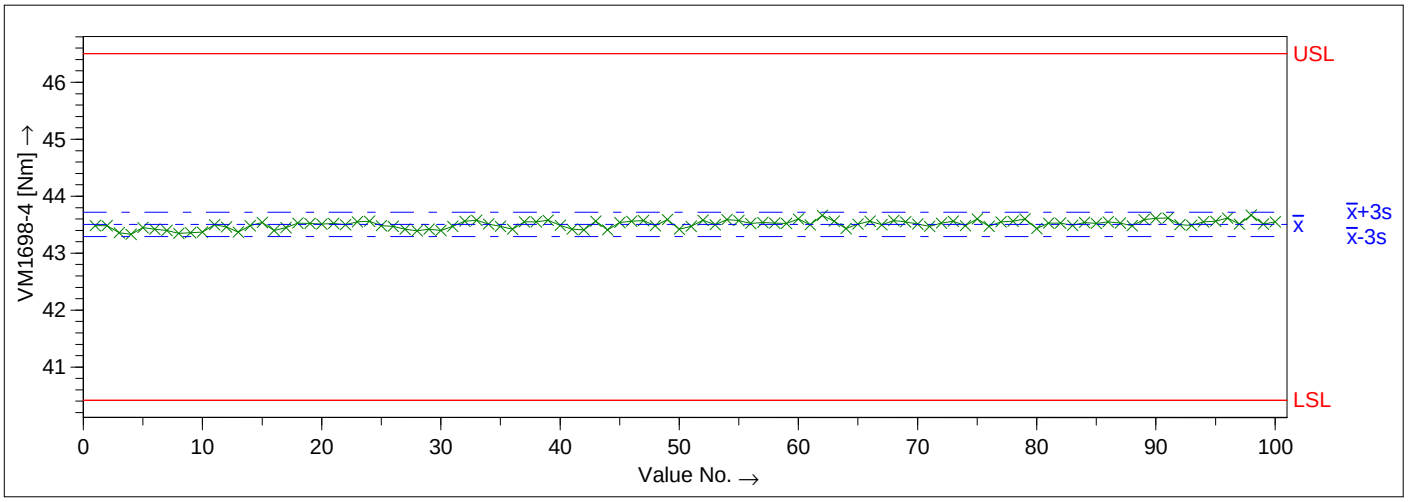
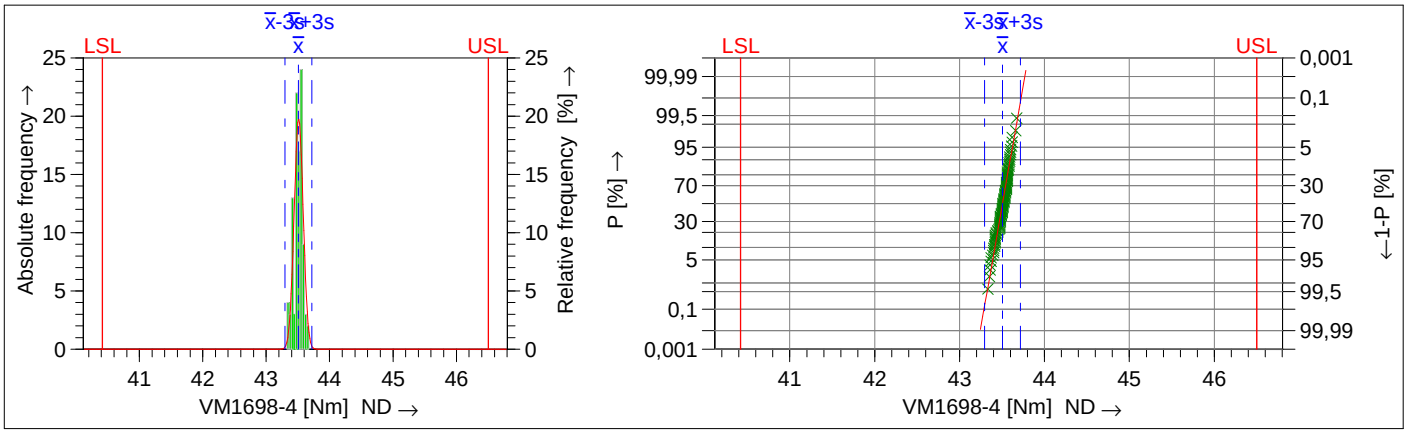
Plant	ATG Westhausen	Operator Name	Sünder
Date	02.02.2022		

Ord. No.	1BD53T2O-A	Part type	1BD-1B060A-1K2D-1VK2D	Contr.item	yes
Serial No.	756027_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 02.02.2022 11:30:09 to 02.02.2022 11:57:04

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			$\bar{x}$	43.5058
LSL	40.42	x_{min}	43.33	$\bar{x}$-3s	43.2941
USL	46.50	x_{max}	43.67	$\bar{x}$+3s	43.7175
T	6.08	R	0.34	6s	0.4234
		$n_{<T>}$	100	$p_{<T>}$	100.00000 %
		$n_{>USL}$	0	$p_{>USL}$	0.00000%
		$n_{<LSL}$	0	$p_{<LSL}$	0.00000%
		n_{eff}	100		
		n_{tot}	100		

Model distribution			Normal Distribution
Calculation method			$M1_{1.4}$ $\hat{\sigma} = s_{tot}$
Potential Capability index	=	C_m	14.36
Critical capability index	=	C_{mk}	14.14

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 02.02.2022

Ser.No.	756027_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	43,48	43,48	43,36	43,33	43,45	43,42	43,40	43,35	43,36	43,37
1024210	VM1698-4	355,00	358,25	360,25	360,25	365,00	366,00	364,25	364,50	363,25	365,25

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	43,50	43,46	43,37	43,48	43,54	43,40	43,45	43,53	43,52	43,51
1024210	VM1698-4	361,25	373,75	368,00	368,75	363,75	360,50	357,75	359,25	359,25	362,50

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	43,52	43,50	43,55	43,56	43,48	43,47	43,42	43,39	43,42	43,40
1024210	VM1698-4	361,25	361,75	364,50	364,75	362,00	362,50	360,00	360,75	364,50	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}
1024210	VM1698-4	43,47	43,56	43,58	43,51	43,47	43,42	43,55	43,55	43,58	43,49
1024210	VM1698-4	355,00	363,00	361,00	358,25	358,25	355,25	360,50	364,25	364,25	364,50

Char.No	Char.Descr.	x_{41}	x_{42}	x_{43}	x_{44}	x_{45}	x_{46}	x_{47}	x_{48}	x_{49}	x_{50}
1024210	VM1698-4	43,42	43,41	43,56	43,41	43,54	43,56	43,57	43,48	43,59	43,42
1024210	VM1698-4	360,75	359,50	360,75	361,25	368,00	366,25	364,75	363,00	369,50	367,25

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	43,47	43,58	43,50	43,59	43,57	43,52	43,54	43,53	43,52	43,60
1024210	VM1698-4	365,00	360,00	362,50	362,75	361,00	363,25	363,50	363,00	359,75	363,50

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	43,50	43,66	43,56	43,43	43,51	43,56	43,50	43,57	43,55	43,51
1024210	VM1698-4	359,25	370,75	366,50	363,75	362,75	365,25	365,00	365,00	366,75	369,25

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	43,47	43,53	43,56	43,48	43,60	43,47	43,55	43,56	43,60	43,43
1024210	VM1698-4	362,50	361,25	363,25	358,75	369,75	361,00	362,00	366,00	362,50	361,50

Machine Capability Study
Control System

Plant	ATG Westhausen		Operator Name	Sünder	Date 02.02.2022

Ser.No.	756027_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	43,53	43,53	43,49	43,54	43,52	43,55	43,53	43,48	43,59	43,61
1024210	VM1698-4	362,50	364,00	361,25	365,25	366,25	367,75	366,25	365,25	364,25	370,50

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	43,62	43,50	43,49	43,55	43,56	43,62	43,51	43,67	43,51	43,55
1024210	VM1698-4	366,00	364,25	365,50	360,50	362,75	369,75	364,75	369,50	364,50	365,50

Machine Capability Study
Tool System

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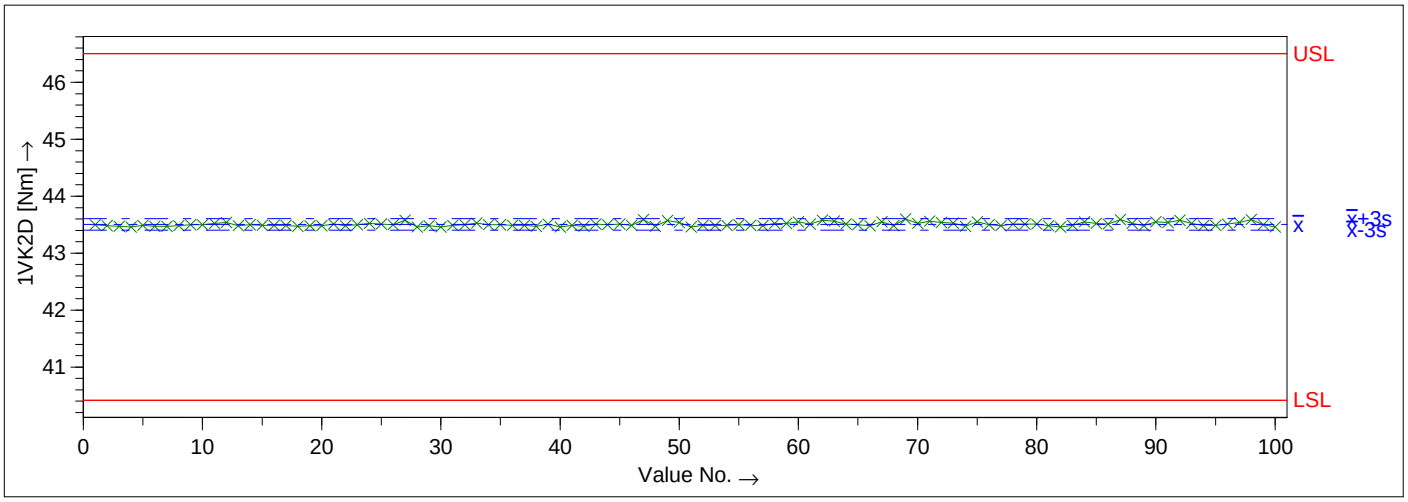
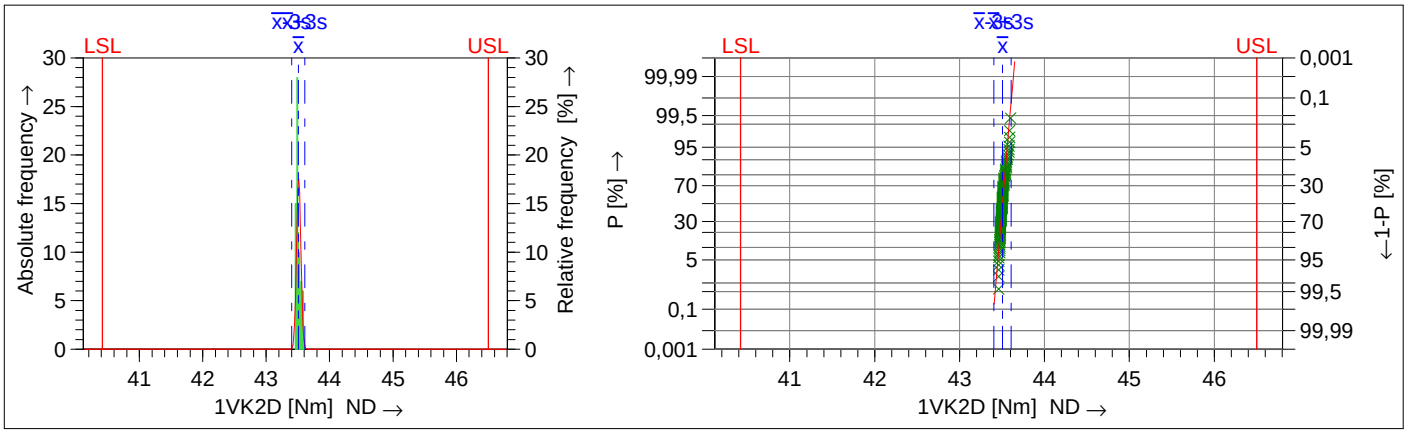
Plant	ATG Westhausen	Operator Name	Sünder
Date	02.02.2022		

Ord. No.	1BD53T2O-A	Part type	1BD-1B060A-1K2D-1VK2D	Contr.item	yes
Serial No.	756027_g	Char.Descr.	1VK2D	Inspection Val. 43,46 3,04	USL 46,50
		Serial No.	200692_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 02.02.2022 11:30:10 to 02.02.2022 11:57:04

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			$\bar{x}$	43.5063
LSL	40.42	x_{min}	43.46	$\bar{x}$-3s	43.4044
USL	46.50	x_{max}	43.60	$\bar{x}$+3s	43.6082
T	6.08	R	0.14	6s	0.2037
		$n_{<T>}$	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	29.84
Critical capability index	=	C_{mk}	29.39

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

APEX VDI/VDE 2647 V0.1

Apex Tool Group GmbH \\htwe0006\AppData\QW\QWE\MessWert\2022\756027_g1.DFD

Machine Capability Study
Tool System

Plant	ATG Westhausen		Operator Name	Sünder	Date 02.02.2022

Ser.No.	756027_g	Characteristic			
Type	1BD-1B060A-1K2D-1VK2D	Char.Descr.	1VK2D	Inspection Val.	43,46
Ord. No.	1BD53T2O-A	Ser.No.	200692_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}
200692_	1VK2D	43,50	43,48	43,47	43,46	43,49	43,47	43,47	43,48	43,50	43,50
200692_	1VK2D	355,00	357,00	361,00	361,00	365,00	366,00	367,00	365,00	364,00	366,00

Char.No	Char.Descr.	x_{11}	x_{12}	x_{13}	x_{14}	x_{15}	x_{16}	x_{17}	x_{18}	x_{19}	x_{20}
200692_	1VK2D	43,52	43,54	43,48	43,50	43,49	43,49	43,49	43,47	43,48	43,48
200692_	1VK2D	361,00	373,00	368,00	368,00	363,00	360,00	358,00	358,00	358,00	361,00

Char.No	Char.Descr.	x_{21}	x_{22}	x_{23}	x_{24}	x_{25}	x_{26}	x_{27}	x_{28}	x_{29}	x_{30}
200692_	1VK2D	43,51	43,48	43,50	43,52	43,51	43,50	43,58	43,46	43,48	43,46
200692_	1VK2D	360,00	361,00	364,00	364,00	362,00	362,00	361,00	361,00	365,00	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}
200692_	1VK2D	43,49	43,50	43,53	43,50	43,50	43,49	43,49	43,47	43,51	43,46
200692_	1VK2D	355,00	362,00	359,00	357,00	357,00	358,00	360,00	363,00	362,00	364,00

Char.No	Char.Descr.	x_{41}	x_{42}	x_{43}	x_{44}	x_{45}	x_{46}	x_{47}	x_{48}	x_{49}	x_{50}
200692_	1VK2D	43,49	43,47	43,51	43,50	43,51	43,49	43,59	43,47	43,57	43,54
200692_	1VK2D	361,00	359,00	359,00	361,00	367,00	366,00	364,00	362,00	367,00	367,00

Char.No	Char.Descr.	x_{51}	x_{52}	x_{53}	x_{54}	x_{55}	x_{56}	x_{57}	x_{58}	x_{59}	x_{60}
200692_	1VK2D	43,46	43,49	43,48	43,49	43,50	43,49	43,48	43,52	43,52	43,55
200692_	1VK2D	364,00	359,00	363,00	361,00	359,00	363,00	363,00	362,00	359,00	363,00

Char.No	Char.Descr.	x_{61}	x_{62}	x_{63}	x_{64}	x_{65}	x_{66}	x_{67}	x_{68}	x_{69}	x_{70}
200692_	1VK2D	43,51	43,58	43,56	43,51	43,50	43,48	43,55	43,48	43,60	43,52
200692_	1VK2D	359,00	370,00	366,00	363,00	362,00	363,00	365,00	364,00	366,00	368,00

Char.No	Char.Descr.	x_{71}	x_{72}	x_{73}	x_{74}	x_{75}	x_{76}	x_{77}	x_{78}	x_{79}	x_{80}
200692_	1VK2D	43,56	43,54	43,53	43,47	43,55	43,50	43,48	43,51	43,51	43,51
200692_	1VK2D	363,00	361,00	361,00	359,00	367,00	360,00	361,00	365,00	361,00	361,00

Machine Capability Study
Tool System

Plant	ATG Westhausen		Operator Name	Sünder	Date 02.02.2022

Ser.No.	756027_g	Characteristic			
Type	1BD-1B060A-1K2D-1VK2D	Char.Descr.	1VK2D	Inspection Val.	43,46
Ord. No.	1BD53T2O-A	Ser.No.	200692_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}
200692_	1VK2D	43,48	43,46	43,49	43,55	43,52	43,51	43,59	43,52	43,48	43,55
200692_	1VK2D	362,00	363,00	361,00	365,00	365,00	366,00	366,00	365,00	362,00	368,00

Char.No	Char.Descr.	x_{91}	x_{92}	x_{93}	x_{94}	x_{95}	x_{96}	x_{97}	x_{98}	x_{99}	x_{100}
200692_	1VK2D	43,54	43,58	43,52	43,48	43,49	43,51	43,54	43,59	43,50	43,46
200692_	1VK2D	365,00	364,00	365,00	359,00	361,00	367,00	364,00	368,00	363,00	364,00

Machine Capability Study
Tool System

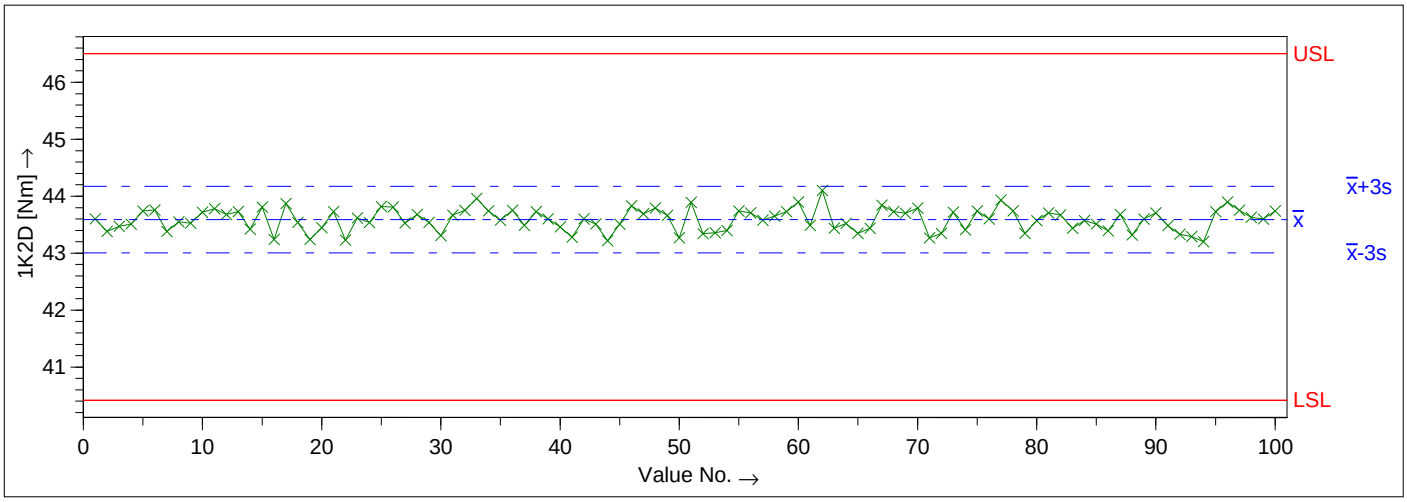
Page 1 / 1

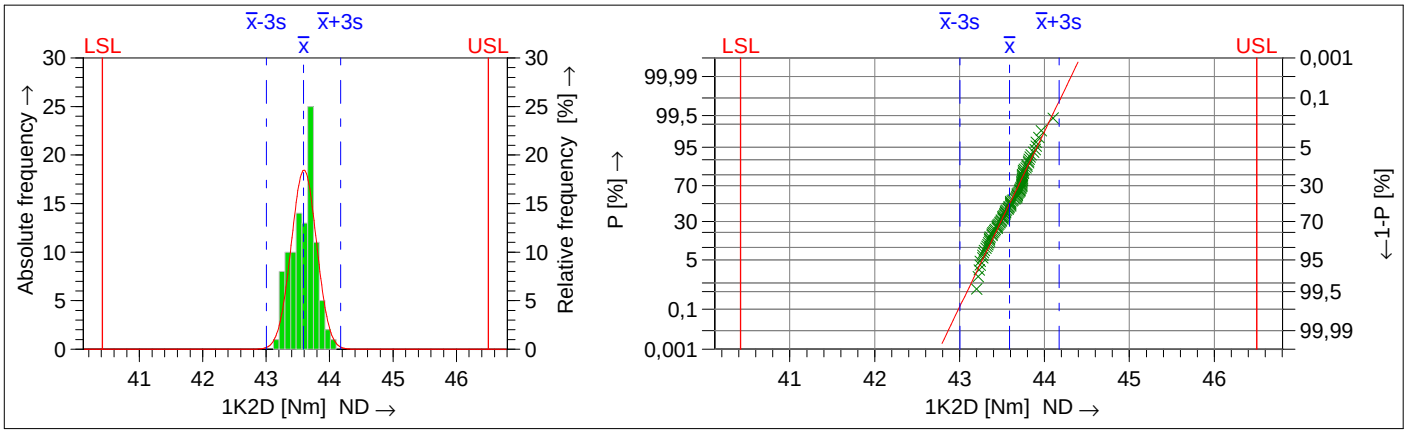
Plant ATG Westhausen		Operator Name Sünder	Date 02.02.2022

Ord. No. 1BD53T2O-A	Part type 1BD-1B060A-1K2D-1VK2D				Contr.item yes
Serial No. 756027_g	Char.Descr. 1K2D	Inspection Val.	43,46	3,04	USL 46,50
	Serial No. 202851	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 02.02.2022 11:30:10 to 02.02.2022 11:57:04

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			$\bar{x}$	43.5893
LSL	40.42	x_{min}	43.20	$\bar{x}$-3s	43.0054
USL	46.50	x_{max}	44.10	$\bar{x}$+3s	44.1732
T	6.08	R	0.90	6s	1.1678
		$n_{<T>}$	100	$p_{<T>}$	100.00000 %
		$n_{>USL}$	0	$p_{>USL}$	0.00000%
		$n_{<LSL}$	0	$p_{<LSL}$	0.00000%
		n_{eff}	100		
		n_{tot}	100		

Model distribution			Normal Distribution
Calculation method			M1 1.4 $\hat{\sigma} = s_{tot}$
Potential Capability index	=	C_m	5.21
Critical capability index	=	C_{mk}	4.98

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 02.02.2022

Ser.No.	756027_g	Characteristic			
Type	1BD-1B060A-1K2D-1VK2D	Char.Descr.	1K2D	Inspection Val.	43,46
Ord. No.	1BD53T2O-A	Ser.No.	202851	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}
202851	1K2D	43,60	43,38	43,47	43,51	43,74	43,76	43,38	43,55	43,53	43,72
202851	1K2D	355,00	357,00	361,00	361,00	365,00	366,00	367,00	365,00	364,00	366,00

Char.No	Char.Descr.	x_{11}	x_{12}	x_{13}	x_{14}	x_{15}	x_{16}	x_{17}	x_{18}	x_{19}	x_{20}
202851	1K2D	43,78	43,68	43,73	43,42	43,81	43,24	43,87	43,54	43,24	43,45
202851	1K2D	361,00	373,00	368,00	368,00	363,00	360,00	358,00	358,00	358,00	361,00

Char.No	Char.Descr.	x_{21}	x_{22}	x_{23}	x_{24}	x_{25}	x_{26}	x_{27}	x_{28}	x_{29}	x_{30}
202851	1K2D	43,73	43,23	43,62	43,54	43,82	43,81	43,53	43,68	43,54	43,31
202851	1K2D	360,00	361,00	364,00	364,00	362,00	362,00	361,00	361,00	365,00	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}
202851	1K2D	43,67	43,75	43,96	43,74	43,58	43,75	43,49	43,73	43,60	43,46
202851	1K2D	355,00	362,00	359,00	357,00	357,00	358,00	360,00	363,00	362,00	364,00

Char.No	Char.Descr.	x_{41}	x_{42}	x_{43}	x_{44}	x_{45}	x_{46}	x_{47}	x_{48}	x_{49}	x_{50}
202851	1K2D	43,28	43,60	43,51	43,22	43,51	43,83	43,69	43,79	43,66	43,27
202851	1K2D	361,00	359,00	359,00	361,00	367,00	366,00	364,00	362,00	367,00	367,00

Char.No	Char.Descr.	x_{51}	x_{52}	x_{53}	x_{54}	x_{55}	x_{56}	x_{57}	x_{58}	x_{59}	x_{60}
202851	1K2D	43,89	43,34	43,36	43,40	43,74	43,71	43,58	43,65	43,73	43,90
202851	1K2D	364,00	359,00	363,00	361,00	359,00	363,00	363,00	362,00	359,00	363,00

Char.No	Char.Descr.	x_{61}	x_{62}	x_{63}	x_{64}	x_{65}	x_{66}	x_{67}	x_{68}	x_{69}	x_{70}
202851	1K2D	43,49	44,10	43,44	43,52	43,35	43,44	43,84	43,73	43,70	43,79
202851	1K2D	359,00	370,00	366,00	363,00	362,00	363,00	365,00	364,00	366,00	368,00

Char.No	Char.Descr.	x_{71}	x_{72}	x_{73}	x_{74}	x_{75}	x_{76}	x_{77}	x_{78}	x_{79}	x_{80}
202851	1K2D	43,27	43,35	43,72	43,41	43,74	43,60	43,93	43,74	43,35	43,57
202851	1K2D	363,00	361,00	361,00	359,00	367,00	360,00	361,00	365,00	361,00	361,00

Machine Capability Study
Tool System

Plant	ATG Westhausen		Operator Name	Sünder	Date 02.02.2022

Ser.No.	756027_g	Characteristic			
Type	1BD-1B060A-1K2D-1VK2D	Char.Descr.	1K2D	Inspection Val.	43,46
Ord. No.	1BD53T2O-A	Ser.No.	202851	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}
202851	1K2D	43,71	43,67	43,44	43,57	43,51	43,39	43,68	43,32	43,60	43,71
202851	1K2D	362,00	363,00	361,00	365,00	365,00	366,00	366,00	365,00	362,00	368,00

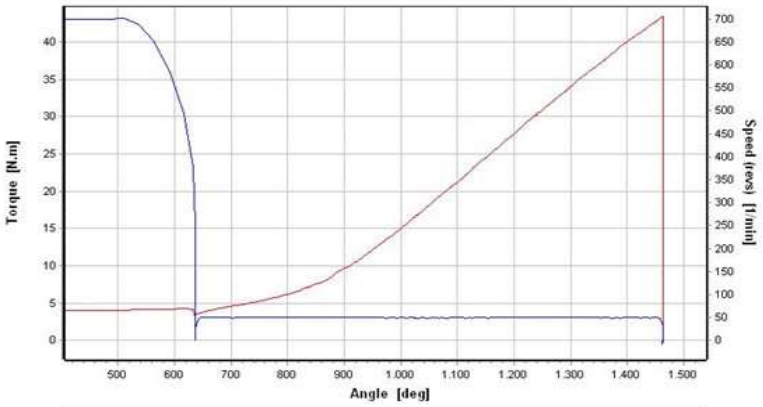
Char.No	Char.Descr.	x_{91}	x_{92}	x_{93}	x_{94}	x_{95}	x_{96}	x_{97}	x_{98}	x_{99}	x_{100}
202851	1K2D	43,48	43,33	43,29	43,20	43,73	43,90	43,75	43,63	43,60	43,74
202851	1K2D	365,00	364,00	365,00	359,00	361,00	367,00	364,00	368,00	363,00	364,00

Torque graphs

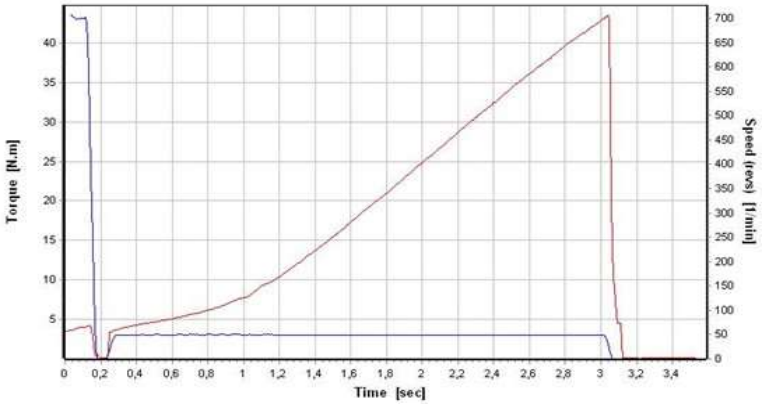
Machine Capability Study 80 %

Model: **1BD-1B060A-1K2D-1VK2D**
Serial no: **756027**

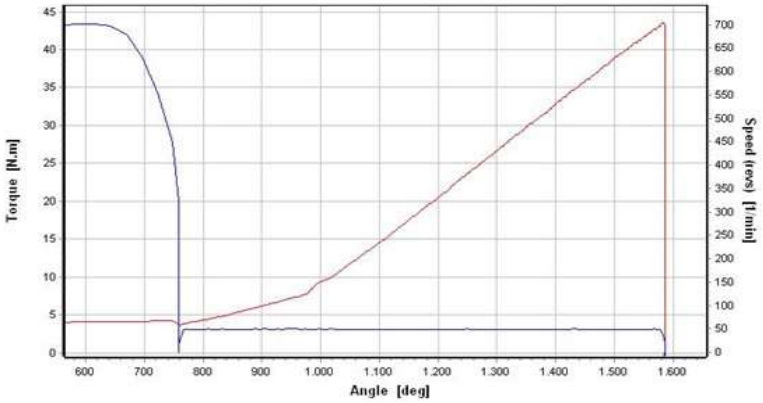
Angle degree: **360°**
Test torque: **43,5 Nm**



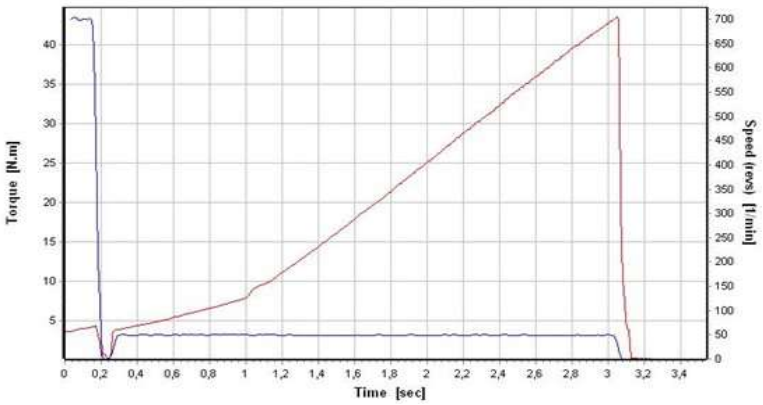
Value no. 1
Graph
Torque / Angle / Speed



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: **756027**

Test torque: Tq max. 53,00 Nm

Hard joint (H)	319,91	Nm / Revolution	Angle degree	30°
Soft joint (L)	26,53	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	53,32	53,07 Nm
	Standard deviation	0,08	0,07 Nm
	Torque scatter (99,73%)	0,45	0,39 Nm
	C_m	16,37	18,80
	C_{mk}	14,96	18,45

b)	Min. C_m hard/soft (lowest value)	16,37
	Min. C_{mk} hard/soft (lowest value)	14,96

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

Note:

Machine Capability Study
Control System

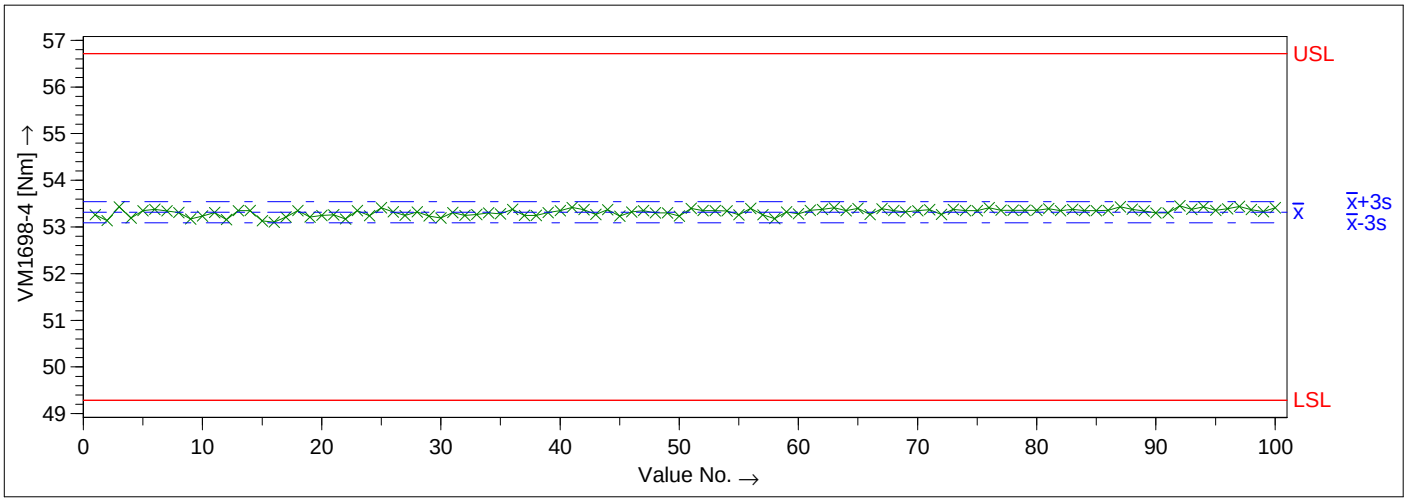
Cleco Production Tools

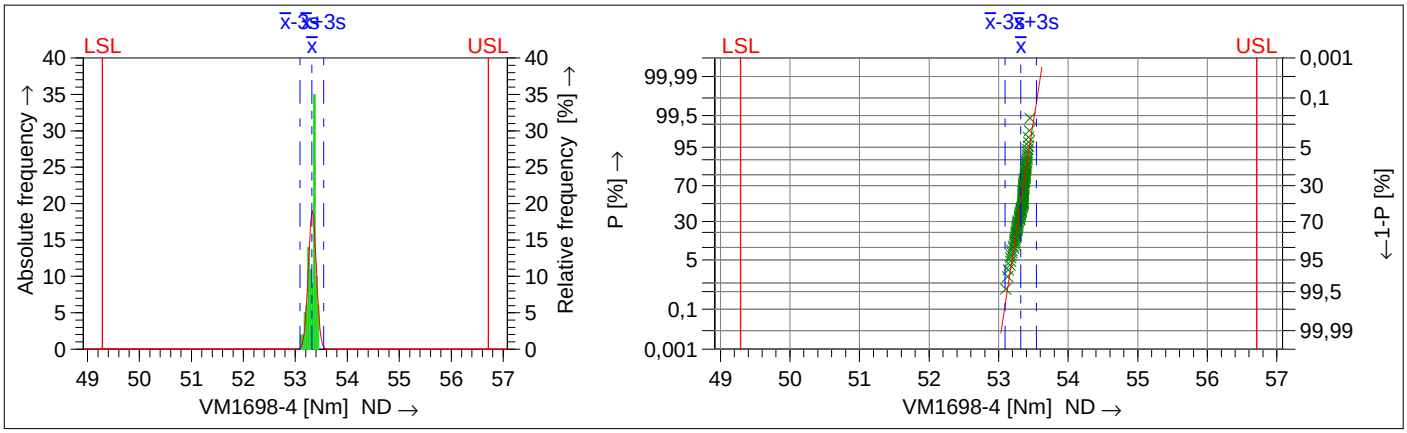
Plant	ATG Westhausen	Operator Name	Sünder
Date	02.02.2022		

Ord. No.	1BD53T2O-A	Part type	1BD-1B060A-1K2D-1VK2D	Contr.item	yes
Serial No.	756027_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 02.02.2022 08:05:31 to 02.02.2022 08:21:24

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			$\bar{x}$	53.3185
LSL	49.29	x_{min}	53.10	$\bar{x}$-3s	53.0918
USL	56.71	x_{max}	53.45	$\bar{x}$+3s	53.5452
T	7.42	R	0.35	6s	0.4533
		$n_{<T>}$	100	$p_{<T>}$	100.00000 %
		$n_{>USL}$	0	$p_{>USL}$	0.00000%
		$n_{<LSL}$	0	$p_{<LSL}$	0.00000%
		n_{eff}	100		
		n_{tot}	100		

Model distribution			Normal Distribution
Calculation method			M1 1.4 $\hat{\sigma} = s_{tot}$
Potential Capability index	=	C_m	16.37
Critical capability index	=	C_{mk}	14.96

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 02.02.2022

Ser.No.	756027_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	53,14	53,43	53,19	53,35	53,38	53,34	53,31	53,17	53,23
1024210	VM1698-4	30,00	30,75	30,75	30,25	30,50	30,75	30,50	29,50	30,75	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	53,31	53,16	53,35	53,35	53,13	53,10	53,21	53,35	53,21	53,25
1024210	VM1698-4	30,25	30,25	30,50	30,50	30,25	30,75	30,25	30,25	27,75	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	53,26	53,17	53,35	53,24	53,41	53,32	53,25	53,32	53,23	53,19
1024210	VM1698-4	30,50	30,25	30,50	30,75	30,75	30,50	30,50	27,75	30,75	30,75

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	53,31	53,25	53,27	53,30	53,28	53,38	53,25	53,25	53,31	53,35
1024210	VM1698-4	30,75	30,75	30,75	30,00	29,75	30,00	30,00	29,75	30,00	29,75

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	53,42	53,37	53,27	53,37	53,23	53,32	53,35	53,30	53,30	53,23
1024210	VM1698-4	30,00	30,00	30,00	29,75	30,00	29,75	30,00	30,00	30,00	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	53,40	53,35	53,35	53,34	53,26	53,40	53,26	53,18	53,32	53,28
1024210	VM1698-4	30,25	30,00	28,50	30,25	28,50	28,75	29,75	30,25	30,75	30,50

Char.No	Char.Descr.	x_{61}	x_{62}	x_{63}	x_{64}	x_{65}	x_{66}	x_{67}	x_{68}	x_{69}	x_{70}
1024210	VM1698-4	53,36	53,38	53,41	53,35	53,40	53,27	53,39	53,35	53,32	53,35
1024210	VM1698-4	30,50	30,50	28,75	30,75	30,75	30,50	30,75	29,50	30,75	30,50

Char.No	Char.Descr.	x_{71}	x_{72}	x_{73}	x_{74}	x_{75}	x_{76}	x_{77}	x_{78}	x_{79}	x_{80}
1024210	VM1698-4	53,37	53,27	53,38	53,35	53,35	53,41	53,36	53,36	53,36	53,36
1024210	VM1698-4	31,00	31,00	30,75	30,50	30,50	30,50	30,75	30,25	30,25	30,00

Machine Capability Study
Control System

Plant	ATG Westhausen		Operator Name	Sünder	Date 02.02.2022

Ser.No.	756027_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	53,39	53,35	53,38	53,35	53,35	53,36	53,43	53,38	53,34	53,30
1024210	VM1698-4	30,00	30,25	30,00	30,00	29,75	30,00	30,00	30,25	30,00	30,25

Char.No	Char.Descr.	x_{91}	x_{92}	x_{93}	x_{94}	x_{95}	x_{96}	x_{97}	x_{98}	x_{99}	x_{100}
1024210	VM1698-4	53,30	53,45	53,38	53,43	53,36	53,39	53,44	53,37	53,33	53,41
1024210	VM1698-4	30,25	30,50	30,00	30,25	30,00	30,25	30,25	30,25	30,25	30,25

Machine Capability Study
Tool System

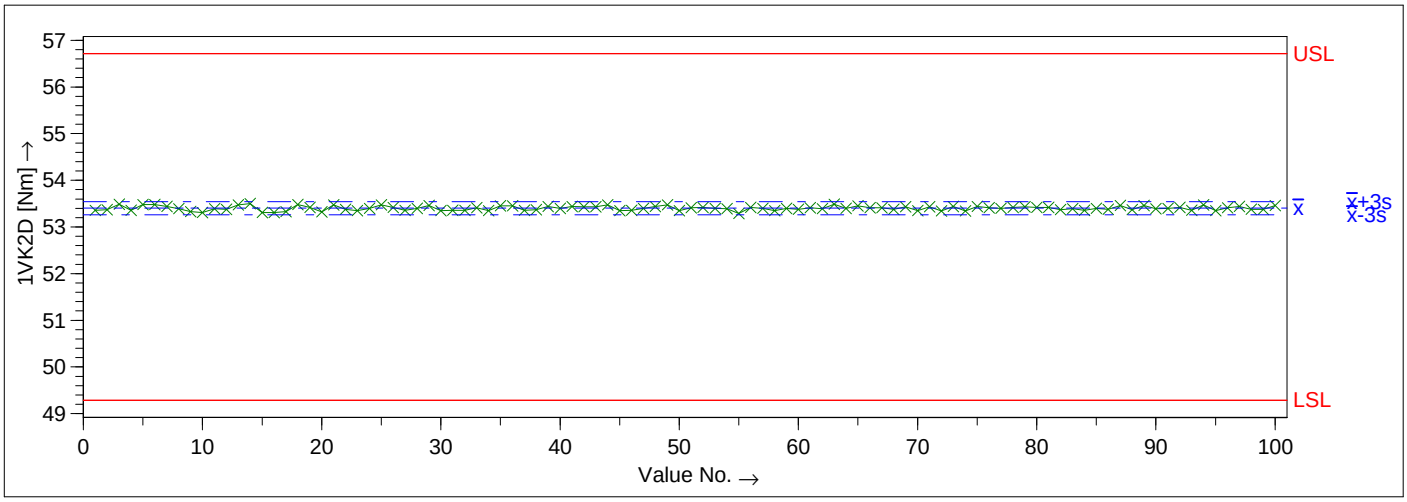
Page 1 / 1

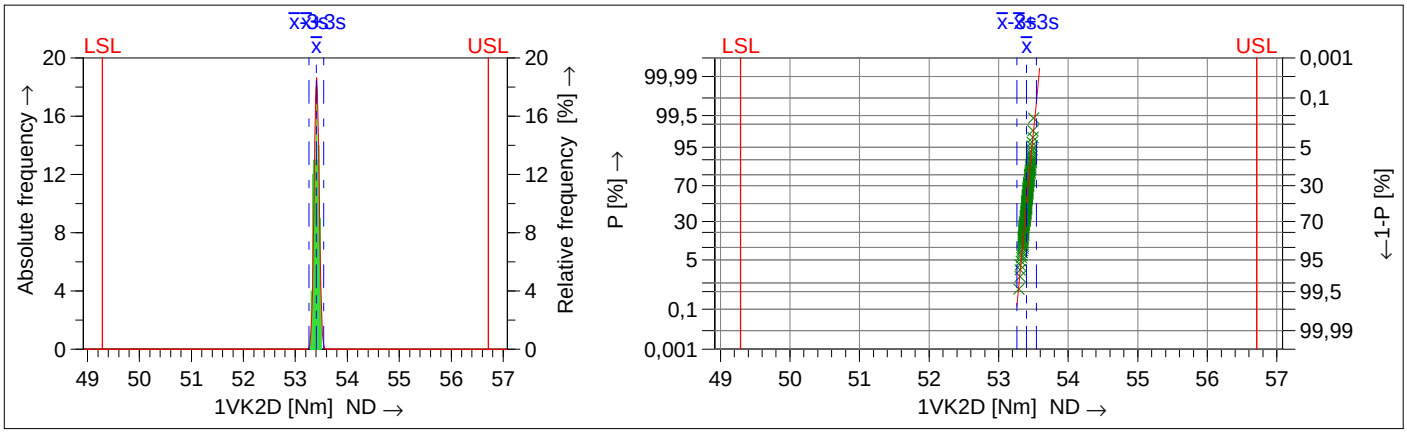
Plant	ATG Westhausen	Operator Name	Sünder
Date	02.02.2022		

Ord. No.	1BD53T2O-A	Part type	1BD-1B060A-1K2D-1VK2D	Contr.item	yes
Serial No.	756027_b	Char.Descr.	1VK2D	Inspection Val. 53,00 3,71	USL 56,71
		Serial No.	200692_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 02.02.2022 08:05:31 to 02.02.2022 08:21:25

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			$\bar{x}$	53.4019
LSL	49.29	x_{min}	53.29	$\bar{x}$-3s	53.2614
USL	56.71	x_{max}	53.50	$\bar{x}$+3s	53.5424
T	7.42	R	0.21	6s	0.2810
		$n_{<T>}$	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	26.41
Critical capability index	=	C_{mk}	23.55

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

APEX VDI/VDE 2647 V0.1

Apex Tool Group GmbH \\htwe0006\AppData\QW\QWE\MessWert\2022\756027_b1.DFD

Machine Capability Study
Tool System

Plant	ATG Westhausen		Operator Name	Sünder	Date 02.02.2022

Ser.No.	756027_b	Characteristic			
Type	1BD-1B060A-1K2D-1VK2D	Char.Descr.	1VK2D	Inspection Val.	53,00
Ord. No.	1BD53T2O-A	Ser.No.	200692_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}
200692_	1VK2D	53,36	53,37	53,49	53,36	53,48	53,48	53,44	53,39	53,33	53,31
200692_	1VK2D	30,00	31,00	31,00	31,00	31,00	31,00	31,00	31,00	31,00	31,00

Char.No	Char.Descr.	x_{11}	x_{12}	x_{13}	x_{14}	x_{15}	x_{16}	x_{17}	x_{18}	x_{19}	x_{20}
200692_	1VK2D	53,39	53,38	53,47	53,50	53,31	53,31	53,33	53,48	53,42	53,32
200692_	1VK2D	31,00	31,00	31,00	30,00	30,00	31,00	30,00	31,00	31,00	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}
200692_	1VK2D	53,47	53,38	53,35	53,40	53,47	53,42	53,36	53,40	53,46	53,35
200692_	1VK2D	31,00	31,00	30,00	31,00	31,00	31,00	31,00	31,00	31,00	31,00

Char.No	Char.Descr.	x_{31}	x_{32}	x_{33}	x_{34}	x_{35}	x_{36}	x_{37}	x_{38}	x_{39}	x_{40}
200692_	1VK2D	53,36	53,36	53,41	53,35	53,45	53,45	53,36	53,37	53,44	53,40
200692_	1VK2D	31,00	31,00	31,00	30,00	30,00	30,00	30,00	30,00	30,00	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}
200692_	1VK2D	53,44	53,43	53,43	53,47	53,35	53,36	53,40	53,44	53,47	53,35
200692_	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}
200692_	1VK2D	53,41	53,42	53,40	53,39	53,29	53,42	53,40	53,35	53,40	53,38
200692_	1VK2D	30,00	30,00	30,00	30,00	30,00	30,00	30,00	31,00	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}
200692_	1VK2D	53,41	53,39	53,49	53,40	53,45	53,41	53,41	53,38	53,43	53,35
200692_	1VK2D	31,00	31,00	30,00	31,00	31,00	31,00	31,00	31,00	31,00	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}
200692_	1VK2D	53,43	53,34	53,44	53,34	53,44	53,41	53,40	53,42	53,43	53,42
200692_	1VK2D	31,00	31,00	31,00	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 02.02.2022

Ser.No.	756027_b	Characteristic			
Type	1BD-1B060A-1K2D-1VK2D	Char.Descr.	1VK2D	Inspection Val.	53,00
Ord. No.	1BD53T2O-A	Ser.No.	200692_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}
200692_	1VK2D	53,42	53,37	53,39	53,36	53,40	53,38	53,46	53,37	53,46	53,39
200692_	1VK2D	30,00	30,00	30,00	30,00	30,00	30,00	30,00	30,00	30,00	31,00

Char.No	Char.Descr.	x_{91}	x_{92}	x_{93}	x_{94}	x_{95}	x_{96}	x_{97}	x_{98}	x_{99}	x_{100}
200692_	1VK2D	53,40	53,42	53,36	53,47	53,35	53,41	53,44	53,38	53,38	53,46
200692_	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

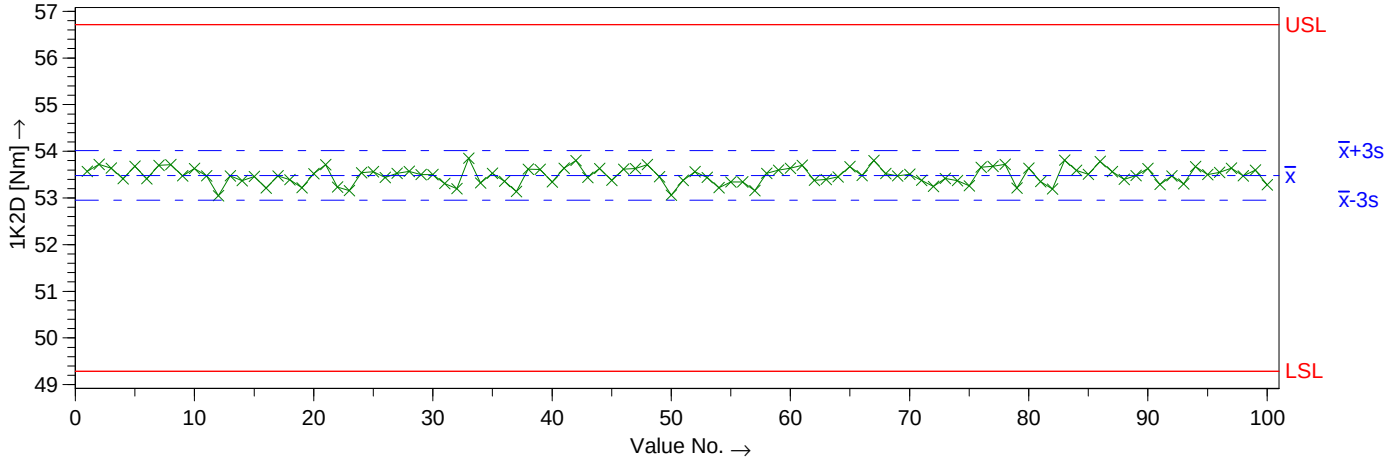
Plant	ATG Westhausen	Operator Name	Sünder
Date	02.02.2022		

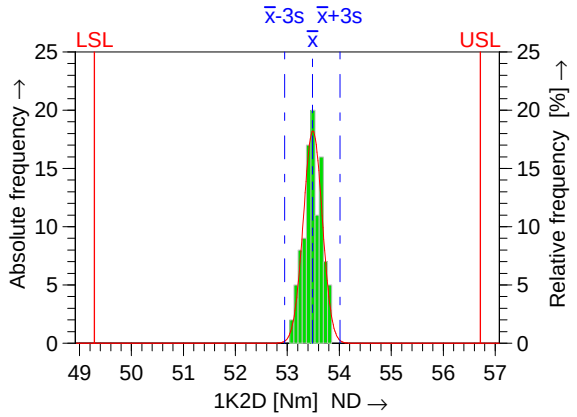
Ord. No.	1BD53T2O-A	Part type	1BD-1B060A-1K2D-1VK2D	Contr.item	yes
Serial No.	756027_b	Char.Descr.	1K2D	Inspection Val. 53,00 3,71	USL 56,71
		Serial No.	202851	Unit Nm -3,71	LSL 49,29
Char.Type	variable			Tolerance value 7 %	Decimal Pl. 2

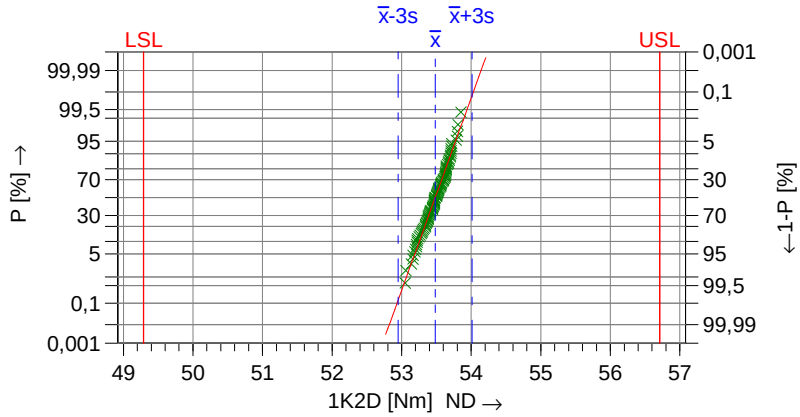
Cust.Name	Cleco	Reference System	VM1698-4	Test Electronic	MPRO400GCD-P
Contr.No.	Homologation	Reference Transducer	50 / 1024729	nges.	100

Evaluation from 02.02.2022 08:05:31 to 02.02.2022 08:21:25

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			$\bar{x}$	53.4820
LSL	49.29	x_{min}	53.05	$\bar{x}$-3s	52.9497
USL	56.71	x_{max}	53.85	$\bar{x}$+3s	54.0143
T	7.42	R	0.80	6s	1.0645
		$n_{<T>}$	100	$p_{<T>}$	100.00000 %
		$n_{>USL}$	0	$p_{>USL}$	0.00000%
		$n_{<LSL}$	0	$p_{<LSL}$	0.00000%
		n_{eff}	100		
		n_{tot}	100		

Model distribution			Normal Distribution
Calculation method			$M1_{1,4}$ $\hat{\sigma} = s_{tot}$
Potential Capability index	=	C_m	6.97
Critical capability index	=	C_{mk}	6.06

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 02.02.2022

Ser.No.	756027_b	Characteristic			
Type	1BD-1B060A-1K2D-1VK2D	Char.Descr.	1K2D	Inspection Val.	53,00
Ord. No.	1BD53T2O-A	Ser.No.	202851	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}
202851	1K2D	53,57	53,72	53,64	53,41	53,68	53,41	53,70	53,71	53,47	53,63
202851	1K2D	30,00	31,00	31,00	31,00	31,00	31,00	31,00	31,00	31,00	31,00

Char.No	Char.Descr.	x_{11}	x_{12}	x_{13}	x_{14}	x_{15}	x_{16}	x_{17}	x_{18}	x_{19}	x_{20}
202851	1K2D	53,47	53,05	53,47	53,37	53,46	53,21	53,47	53,39	53,22	53,52
202851	1K2D	31,00	31,00	31,00	30,00	30,00	31,00	30,00	31,00	31,00	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}
202851	1K2D	53,71	53,23	53,16	53,54	53,56	53,44	53,53	53,57	53,50	53,50
202851	1K2D	31,00	31,00	30,00	31,00	31,00	31,00	31,00	31,00	31,00	31,00

Char.No	Char.Descr.	x_{31}	x_{32}	x_{33}	x_{34}	x_{35}	x_{36}	x_{37}	x_{38}	x_{39}	x_{40}
202851	1K2D	53,31	53,20	53,85	53,32	53,53	53,36	53,14	53,62	53,61	53,34
202851	1K2D	31,00	31,00	31,00	30,00	30,00	30,00	30,00	30,00	30,00	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}
202851	1K2D	53,64	53,80	53,44	53,63	53,38	53,62	53,63	53,71	53,45	53,06
202851	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}
202851	1K2D	53,38	53,56	53,44	53,22	53,34	53,34	53,16	53,53	53,60	53,64
202851	1K2D	30,00	30,00	30,00	30,00	30,00	30,00	30,00	31,00	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}
202851	1K2D	53,70	53,38	53,40	53,45	53,67	53,48	53,80	53,52	53,47	53,51
202851	1K2D	31,00	31,00	30,00	31,00	31,00	31,00	31,00	31,00	31,00	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}
202851	1K2D	53,38	53,25	53,42	53,37	53,26	53,66	53,68	53,72	53,21	53,64
202851	1K2D	31,00	31,00	31,00	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 02.02.2022

Ser.No.	756027_b	Characteristic			
Type	1BD-1B060A-1K2D-1VK2D	Char.Descr.	1K2D	Inspection Val.	53,00
Ord. No.	1BD53T2O-A	Ser.No.	202851	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}
202851	1K2D	53,35	53,19	53,81	53,59	53,51	53,78	53,56	53,40	53,48	53,63
202851	1K2D	30,00	30,00	30,00	30,00	30,00	30,00	30,00	30,00	30,00	31,00

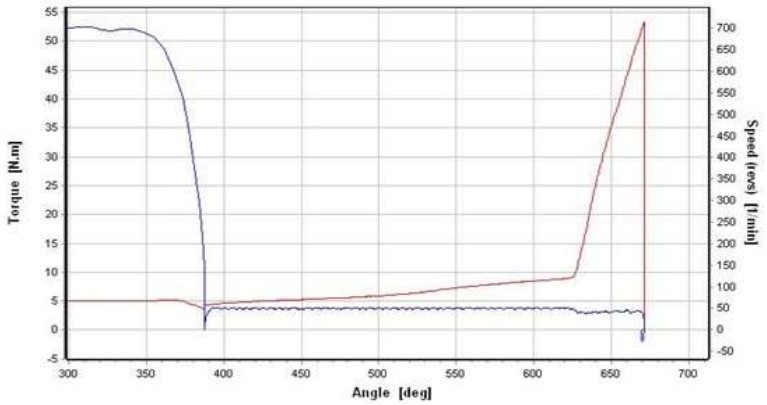
Char.No	Char.Descr.	x_{91}	x_{92}	x_{93}	x_{94}	x_{95}	x_{96}	x_{97}	x_{98}	x_{99}	x_{100}
202851	1K2D	53,29	53,47	53,30	53,67	53,50	53,55	53,64	53,47	53,60	53,28
202851	1K2D	30,00	30,00	30,00	30,00	30,00	30,00	30,00	30,00	30,00	30,00

Torque graphs

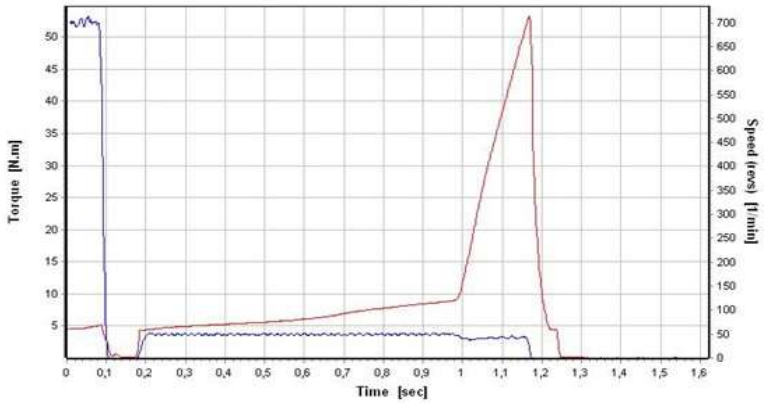
Machine Capability Study 100 %

Model: **1BD-1B060A-1K2D-1VK2D**
Serial no: **756027**

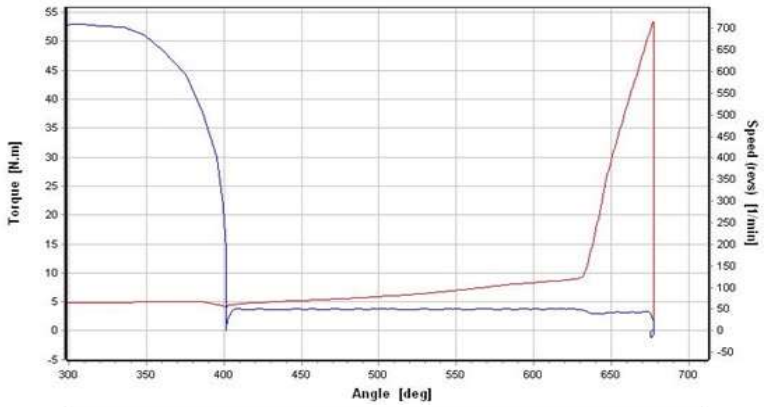
Angle degree: **30°**
Test torque: **53,0 Nm**



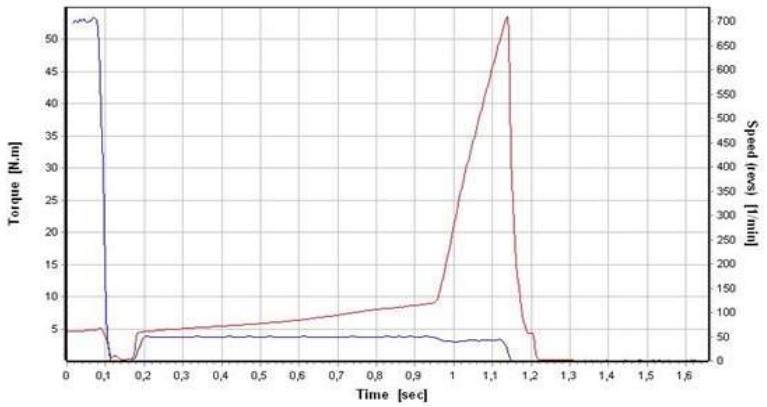
Value no. 1
Graph
Torque / Angle / Speed



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

Cleco Production Tools

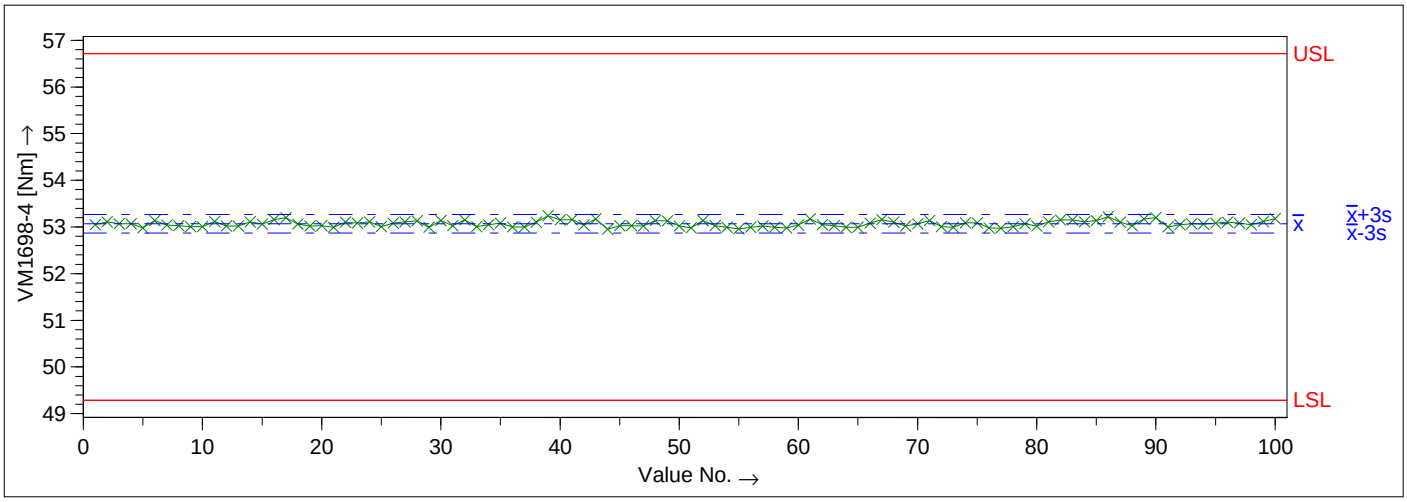
Plant	ATG Westhausen	Operator Name	Sünder
Date	02.02.2022		

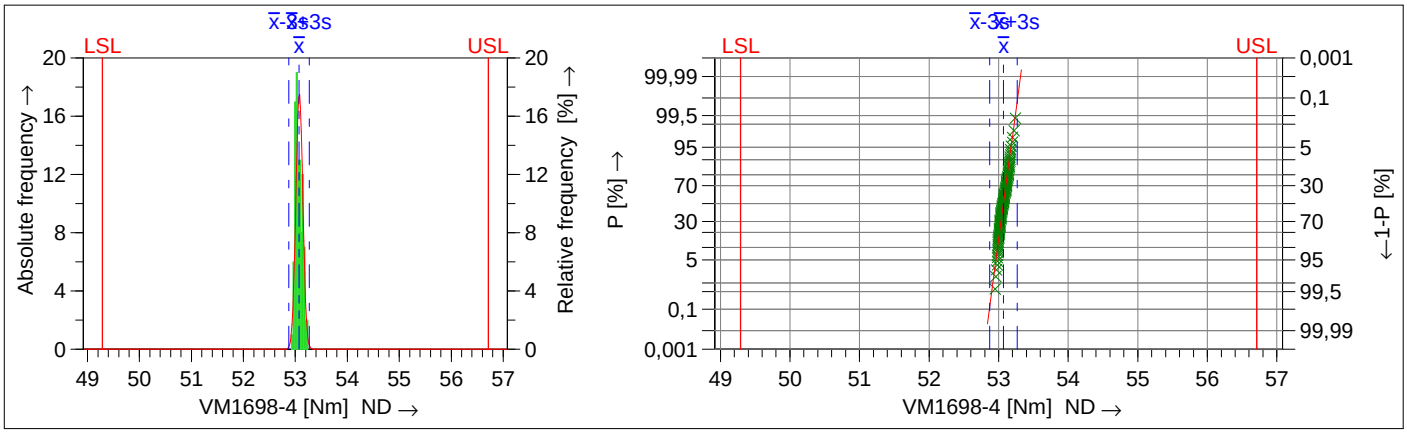
Ord. No.	1BD53T2O-A	Part type	1BD-1B060A-1K2D-1VK2D	Contr.item	yes
Serial No.	756027_a	Char.Descr.	VM1698-4	Inspection Val. 53,00 3,71	USL 56,71
		Serial No.	1024210	Unit Nm -3,71	LSL 49,29
Char.Type	variable			Tolerance value 7 %	Decimal Pl. 2

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

Evaluation from 02.02.2022 12:00:58 to 02.02.2022 13:21:33

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			$\bar{x}$	53.0687
LSL	49.29	x_{min}	52.95	$\bar{x}$-3s	52.8714
USL	56.71	x_{max}	53.24	$\bar{x}$+3s	53.2660
T	7.42	R	0.29	6s	0.3947
		$n_{<T>}$	100	$p_{<T>}$	100.00000 %
		$n_{>USL}$	0	$p_{>USL}$	0.00000%
		$n_{<LSL}$	0	$p_{<LSL}$	0.00000%
		n_{eff}	100		
		n_{tot}	100		

Model distribution			Normal Distribution
Calculation method			$M1_{1.4}$ $\hat{\sigma} = s_{tot}$
Potential Capability index	=	C_m	18.80
Critical capability index	=	C_{mk}	18.45

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 02.02.2022

Ser.No.	756027_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	53,05	53,11	53,07	53,07	52,98	53,14	53,04	53,03	53,01	53,01
1024210	VM1698-4	364,50	360,50	365,25	360,00	358,50	361,75	341,75	338,25	350,00	338,75

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	53,12	53,02	53,02	53,11	53,06	53,16	53,20	53,06	53,02	53,03
1024210	VM1698-4	354,50	333,50	335,25	342,00	348,75	361,50	363,75	362,50	364,25	349,00

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	52,99	53,10	53,08	53,11	53,01	53,08	53,11	53,13	52,99	53,14
1024210	VM1698-4	365,50	362,00	364,00	360,00	361,50	359,75	363,25	364,25	363,00	361,00

Char.No	Char.Descr.	x_{31}	x_{32}	x_{33}	x_{34}	x_{35}	x_{36}	x_{37}	x_{38}	x_{39}	x_{40}
1024210	VM1698-4	53,03	53,15	53,01	53,05	53,08	53,00	53,00	53,10	53,24	53,15
1024210	VM1698-4	359,50	365,00	358,50	358,75	358,50	362,50	360,00	358,25	364,25	361,00

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	53,16	53,04	53,17	52,95	53,03	53,03	53,02	53,14	53,13	53,02
1024210	VM1698-4	363,00	362,00	367,75	355,50	355,75	355,00	357,50	362,75	361,25	359,25

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	52,98	53,14	53,03	52,99	52,96	52,99	53,02	52,99	52,98	53,04
1024210	VM1698-4	361,25	362,25	345,75	364,00	354,75	356,50	354,00	356,50	358,75	358,00

Char.No	Char.Descr.	x_{61}	x_{62}	x_{63}	x_{64}	x_{65}	x_{66}	x_{67}	x_{68}	x_{69}	x_{70}
1024210	VM1698-4	53,17	53,05	53,03	52,99	52,99	53,08	53,16	53,10	53,02	53,07
1024210	VM1698-4	365,00	361,75	359,50	358,50	359,00	352,75	357,00	358,00	359,00	358,25

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	53,14	53,01	52,99	53,09	53,09	52,98	52,97	53,01	53,07	53,02
1024210	VM1698-4	362,00	361,75	359,25	362,00	357,75	338,75	339,75	362,75	366,00	361,00

Machine Capability Study
Control System

Plant	ATG Westhausen		Operator Name	Sünder	Date 02.02.2022

Ser.No.	756027_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	53,11	53,15	53,15	53,11	53,14	53,22	53,10	53,03	53,17	53,20
1024210	VM1698-4	365,75	364,25	372,50	366,00	368,75	359,00	351,50	341,25	365,75	363,75

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	53,00	53,05	53,07	53,06	53,08	53,10	53,08	53,05	53,12	53,18
1024210	VM1698-4	358,25	360,00	359,00	361,25	360,25	361,25	360,50	362,25	362,75	367,00

Machine Capability Study
Tool System

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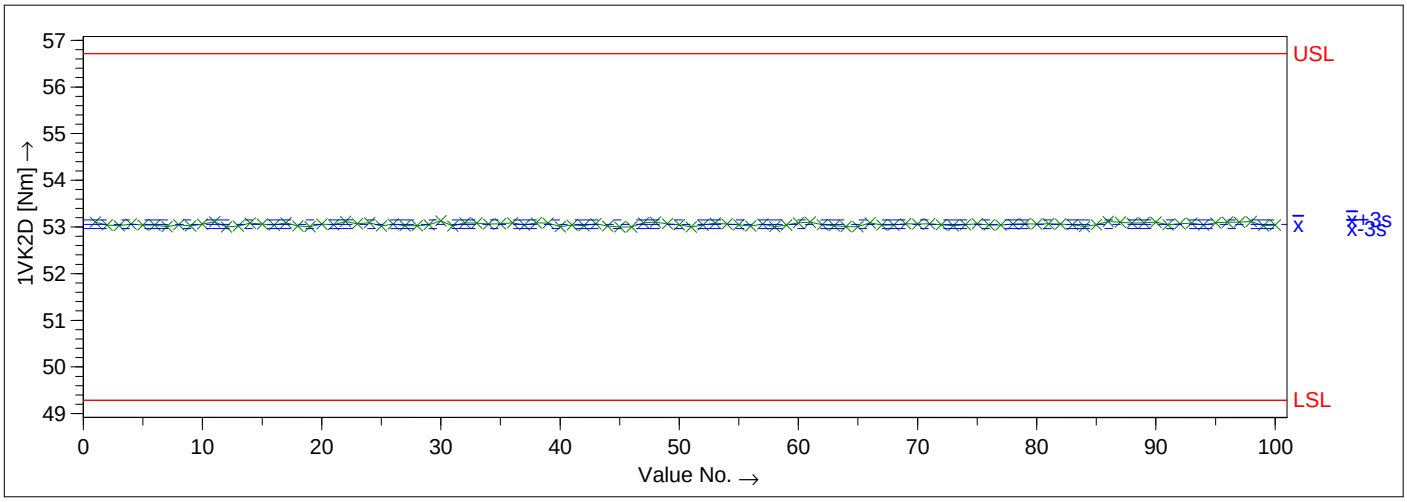
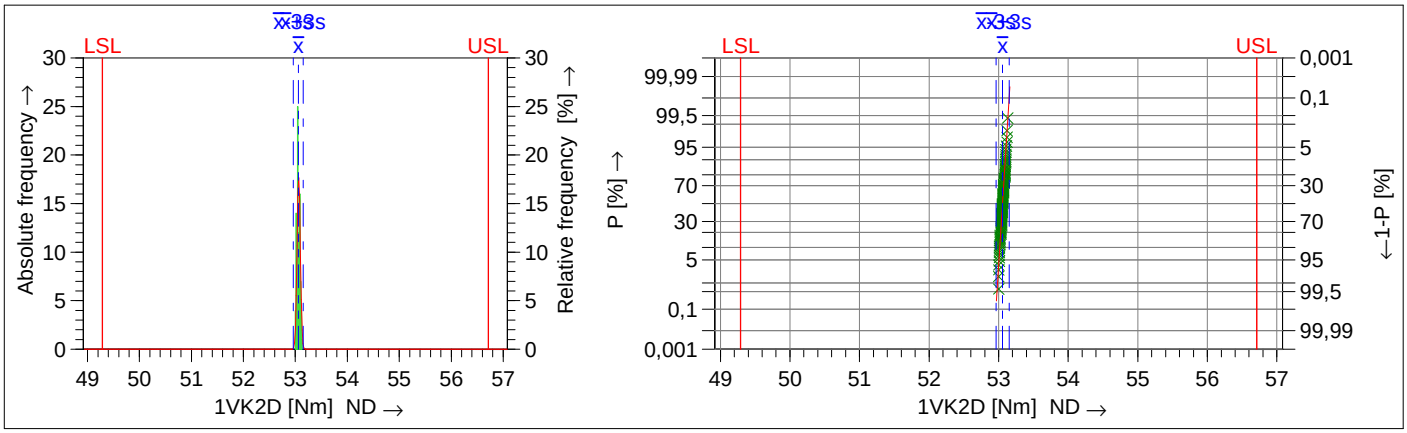
Plant	ATG Westhausen	Operator Name	Sünder
Date	02.02.2022		

Ord. No.	1BD53T2O-A	Part type	1BD-1B060A-1K2D-1VK2D	Contr.item	yes
Serial No.	756027_a	Char.Descr.	1VK2D	Inspection Val. 53,00 3,71	USL 56,71
		Serial No.	200692_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 02.02.2022 12:00:59 to 02.02.2022 13:21:34

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			$\bar{x}$	53.0563
LSL	49.29	x_{min}	53.00	$\bar{x}$-3s	52.9626
USL	56.71	x_{max}	53.13	$\bar{x}$+3s	53.1500
T	7.42	R	0.13	6s	0.1874
		$n_{<T>}$	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	39.60
Critical capability index	=	C_{mk}	39.00

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

APEX VDI/VDE 2647 V0.1

Apex Tool Group GmbH \\htwe0006\AppData\QW\QWE\MessWert\2022\756027_a1.DFD

Machine Capability Study
Tool System

Plant	ATG Westhausen		Operator Name	Sünder	Date 02.02.2022

Ser.No.	756027_a	Characteristic			
Type	1BD-1B060A-1K2D-1VK2D	Char.Descr.	1VK2D	Inspection Val.	53,00
Ord. No.	1BD53T2O-A	Ser.No.	200692_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}
200692_	1VK2D	53,10	53,04	53,03	53,06	53,04	53,04	53,01	53,05	53,02	53,06
200692_	1VK2D	364,00	360,00	365,00	359,00	359,00	360,00	341,00	338,00	350,00	339,00

Char.No	Char.Descr.	x_{11}	x_{12}	x_{13}	x_{14}	x_{15}	x_{16}	x_{17}	x_{18}	x_{19}	x_{20}
200692_	1VK2D	53,11	53,00	53,02	53,08	53,06	53,04	53,09	53,02	53,01	53,06
200692_	1VK2D	354,00	332,00	334,00	341,00	349,00	361,00	362,00	362,00	364,00	349,00

Char.No	Char.Descr.	x_{21}	x_{22}	x_{23}	x_{24}	x_{25}	x_{26}	x_{27}	x_{28}	x_{29}	x_{30}
200692_	1VK2D	53,05	53,12	53,07	53,09	53,02	53,06	53,03	53,03	53,05	53,13
200692_	1VK2D	366,00	362,00	364,00	359,00	362,00	359,00	363,00	363,00	363,00	361,00

Char.No	Char.Descr.	x_{31}	x_{32}	x_{33}	x_{34}	x_{35}	x_{36}	x_{37}	x_{38}	x_{39}	x_{40}
200692_	1VK2D	53,02	53,09	53,08	53,06	53,07	53,09	53,04	53,09	53,08	53,01
200692_	1VK2D	362,00	364,00	359,00	359,00	358,00	363,00	360,00	358,00	363,00	360,00

Char.No	Char.Descr.	x_{41}	x_{42}	x_{43}	x_{44}	x_{45}	x_{46}	x_{47}	x_{48}	x_{49}	x_{50}
200692_	1VK2D	53,04	53,03	53,07	53,02	53,00	53,00	53,09	53,10	53,07	53,05
200692_	1VK2D	364,00	362,00	366,00	356,00	355,00	355,00	358,00	362,00	360,00	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}
200692_	1VK2D	53,00	53,04	53,08	53,06	53,05	53,02	53,06	53,01	53,04	53,09
200692_	1VK2D	361,00	361,00	345,00	364,00	356,00	356,00	355,00	356,00	358,00	358,00

Char.No	Char.Descr.	x_{61}	x_{62}	x_{63}	x_{64}	x_{65}	x_{66}	x_{67}	x_{68}	x_{69}	x_{70}
200692_	1VK2D	53,10	53,05	53,03	53,01	53,01	53,09	53,04	53,04	53,07	53,06
200692_	1VK2D	364,00	362,00	359,00	358,00	359,00	353,00	356,00	357,00	359,00	358,00

Char.No	Char.Descr.	x_{71}	x_{72}	x_{73}	x_{74}	x_{75}	x_{76}	x_{77}	x_{78}	x_{79}	x_{80}
200692_	1VK2D	53,07	53,05	53,03	53,05	53,07	53,04	53,04	53,06	53,07	53,06
200692_	1VK2D	361,00	362,00	359,00	360,00	357,00	338,00	340,00	362,00	366,00	361,00

Machine Capability Study
Tool System

Plant	ATG Westhausen		Operator Name	Sünder	Date 02.02.2022

Ser.No.	756027_a	Characteristic			
Type	1BD-1B060A-1K2D-1VK2D	Char.Descr.	1VK2D	Inspection Val.	53,00
Ord. No.	1BD53T2O-A	Ser.No.	200692_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}
200692_	1VK2D	53,07	53,06	53,05	53,01	53,05	53,12	53,10	53,08	53,09	53,10
200692_	1VK2D	365,00	364,00	372,00	365,00	367,00	361,00	351,00	341,00	365,00	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}
200692_	1VK2D	53,05	53,07	53,08	53,04	53,09	53,10	53,10	53,12	53,03	53,04
200692_	1VK2D	359,00	360,00	359,00	361,00	360,00	361,00	360,00	362,00	362,00	365,00

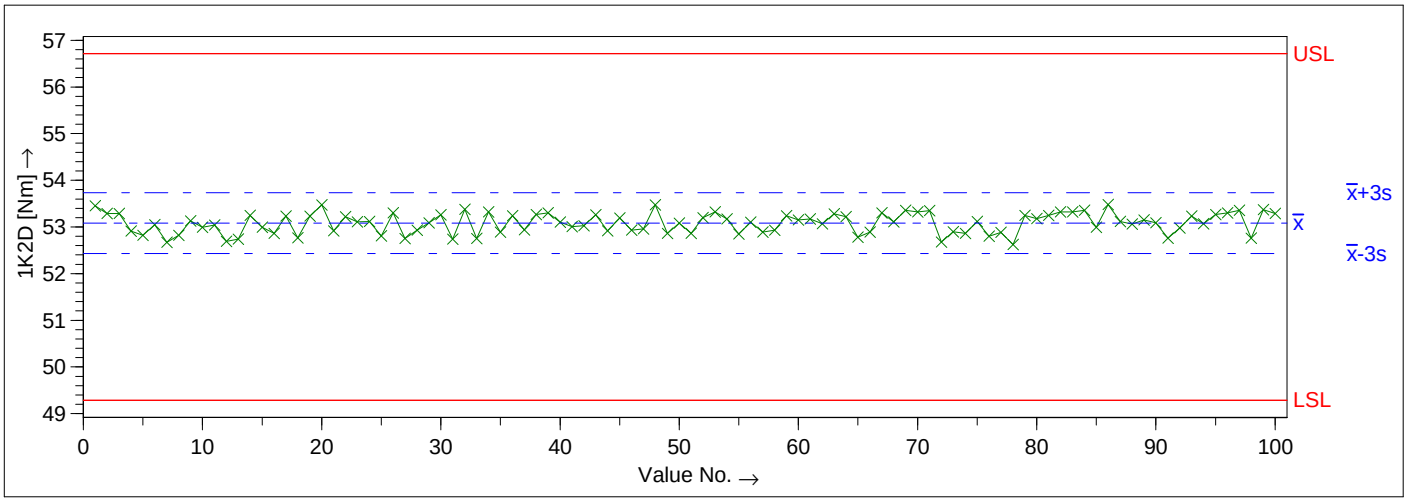
Machine Capability Study
Tool System

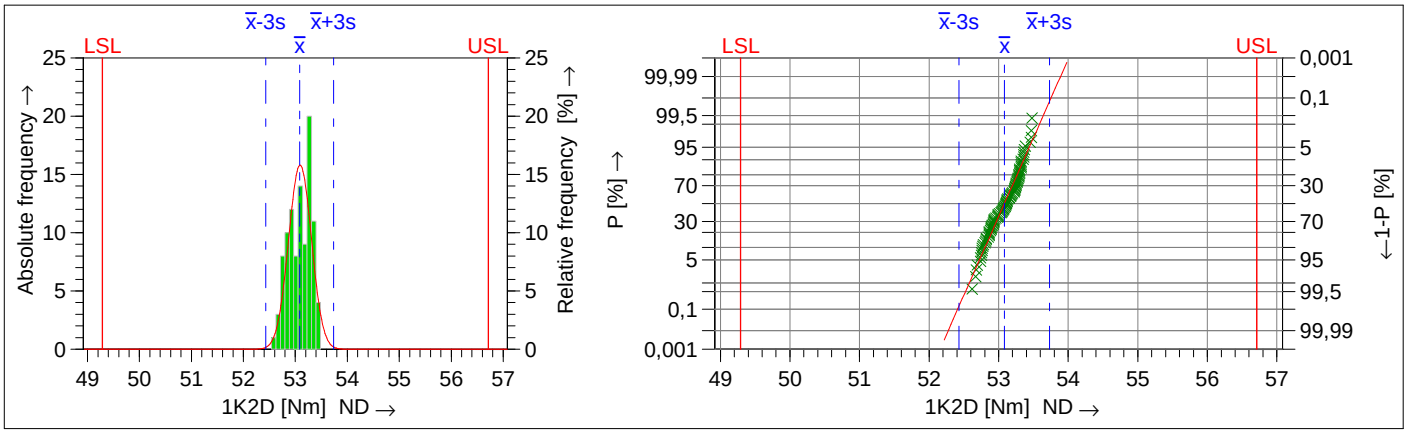
Plant	ATG Westhausen	Operator Name	Sünder
Date	02.02.2022		

Ord. No.	1BD53T2O-A	Part type	1BD-1B060A-1K2D-1VK2D	Contr.item	yes
Serial No.	756027_a	Char.Descr.	1K2D	Inspection Val. 53,00 3,71	USL 56,71
		Serial No.	202851	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 02.02.2022 12:00:59 to 02.02.2022 13:21:34

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			$\bar{x}$	53.0822
LSL	49.29	x_{min}	52.62	$\bar{x}$-3s	52.4311
USL	56.71	x_{max}	53.48	$\bar{x}$+3s	53.7333
T	7.42	R	0.86	6s	1.3021
		$n_{<T>}$	100	$p_{<T>}$	100.00000 %
		$n_{>USL}$	0	$p_{>USL}$	0.00000%
		$n_{<LSL}$	0	$p_{<LSL}$	0.00000%
		n_{eff}	100		
		n_{tot}	100		

Model distribution			Normal Distribution
Calculation method			$M1_{1.4}$ $\hat{\sigma} = s_{tot}$
Potential Capability index	=	C_m	5.70
Critical capability index	=	C_{mk}	5.57

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 02.02.2022

Ser.No.	756027_a	Characteristic			
Type	1BD-1B060A-1K2D-1VK2D	Char.Descr.	1K2D	Inspection Val.	53,00
Ord. No.	1BD53T2O-A	Ser.No.	202851	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}
202851	1K2D	53,45	53,29	53,29	52,91	52,82	53,05	52,67	52,82	53,13	52,99
202851	1K2D	364,00	360,00	365,00	359,00	359,00	360,00	341,00	338,00	350,00	339,00

Char.No	Char.Descr.	x_{11}	x_{12}	x_{13}	x_{14}	x_{15}	x_{16}	x_{17}	x_{18}	x_{19}	x_{20}
202851	1K2D	53,04	52,69	52,74	53,25	52,99	52,86	53,23	52,77	53,23	53,47
202851	1K2D	354,00	332,00	334,00	341,00	349,00	361,00	362,00	362,00	364,00	349,00

Char.No	Char.Descr.	x_{21}	x_{22}	x_{23}	x_{24}	x_{25}	x_{26}	x_{27}	x_{28}	x_{29}	x_{30}
202851	1K2D	52,92	53,22	53,11	53,12	52,81	53,30	52,75	52,93	53,09	53,26
202851	1K2D	366,00	362,00	364,00	359,00	362,00	359,00	363,00	363,00	363,00	361,00

Char.No	Char.Descr.	x_{31}	x_{32}	x_{33}	x_{34}	x_{35}	x_{36}	x_{37}	x_{38}	x_{39}	x_{40}
202851	1K2D	52,74	53,38	52,75	53,32	52,89	53,24	52,94	53,27	53,30	53,10
202851	1K2D	362,00	364,00	359,00	359,00	358,00	363,00	360,00	358,00	363,00	360,00

Char.No	Char.Descr.	x_{41}	x_{42}	x_{43}	x_{44}	x_{45}	x_{46}	x_{47}	x_{48}	x_{49}	x_{50}
202851	1K2D	53,01	53,03	53,26	52,92	53,19	52,93	52,96	53,47	52,86	53,08
202851	1K2D	364,00	362,00	366,00	356,00	355,00	355,00	358,00	362,00	360,00	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}
202851	1K2D	52,86	53,20	53,32	53,17	52,85	53,10	52,89	52,93	53,24	53,15
202851	1K2D	361,00	361,00	345,00	364,00	356,00	356,00	355,00	356,00	358,00	358,00

Char.No	Char.Descr.	x_{61}	x_{62}	x_{63}	x_{64}	x_{65}	x_{66}	x_{67}	x_{68}	x_{69}	x_{70}
202851	1K2D	53,17	53,07	53,28	53,22	52,78	52,89	53,30	53,11	53,36	53,32
202851	1K2D	364,00	362,00	359,00	358,00	359,00	353,00	356,00	357,00	359,00	358,00

Char.No	Char.Descr.	x_{71}	x_{72}	x_{73}	x_{74}	x_{75}	x_{76}	x_{77}	x_{78}	x_{79}	x_{80}
202851	1K2D	53,35	52,68	52,90	52,86	53,12	52,80	52,88	52,62	53,25	53,18
202851	1K2D	361,00	362,00	359,00	360,00	357,00	338,00	340,00	362,00	366,00	361,00

Machine Capability Study
Tool System

Plant	ATG Westhausen		Operator Name	Sünder	Date 02.02.2022

Ser.No.	756027_a	Characteristic			
Type	1BD-1B060A-1K2D-1VK2D	Char.Descr.	1K2D	Inspection Val.	53,00
Ord. No.	1BD53T2O-A	Ser.No.	202851	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}
202851	1K2D	53,25	53,32	53,32	53,36	52,99	53,48	53,12	53,06	53,15	53,09
202851	1K2D	365,00	364,00	372,00	365,00	367,00	361,00	351,00	341,00	365,00	363,00

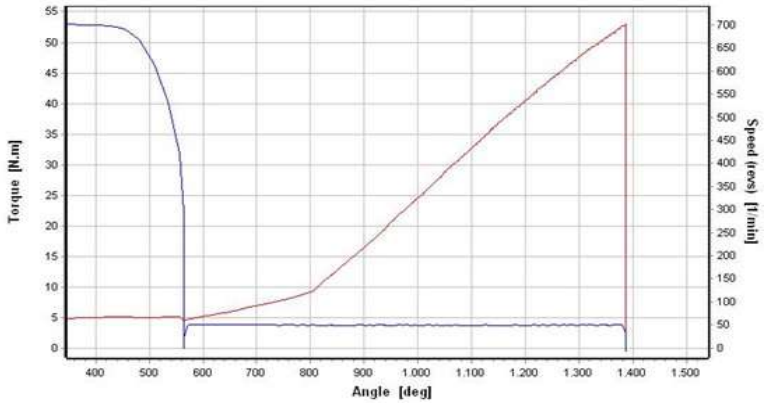
Char.No	Char.Descr.	x_{91}	x_{92}	x_{93}	x_{94}	x_{95}	x_{96}	x_{97}	x_{98}	x_{99}	x_{100}
202851	1K2D	52,76	52,98	53,23	53,07	53,27	53,30	53,36	52,76	53,37	53,29
202851	1K2D	359,00	360,00	359,00	361,00	360,00	361,00	360,00	362,00	362,00	365,00

Torque graphs

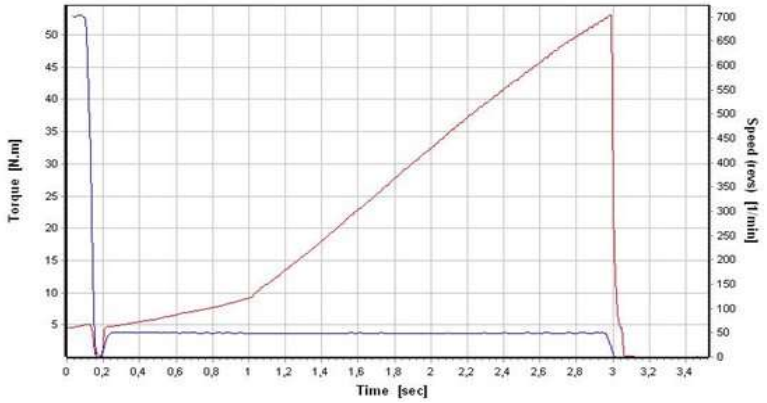
Machine Capability Study 100 %

Model: **1BD-1B060A-1K2D-1VK2D**
Serial no: **756027**

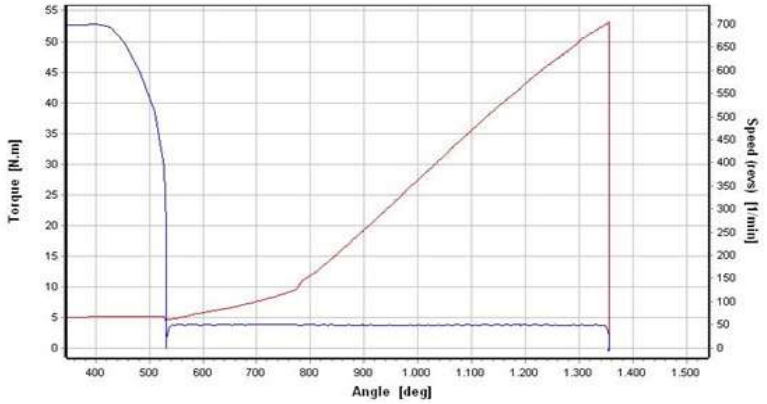
Angle degree: **360°**
Test torque: **53,0 Nm**



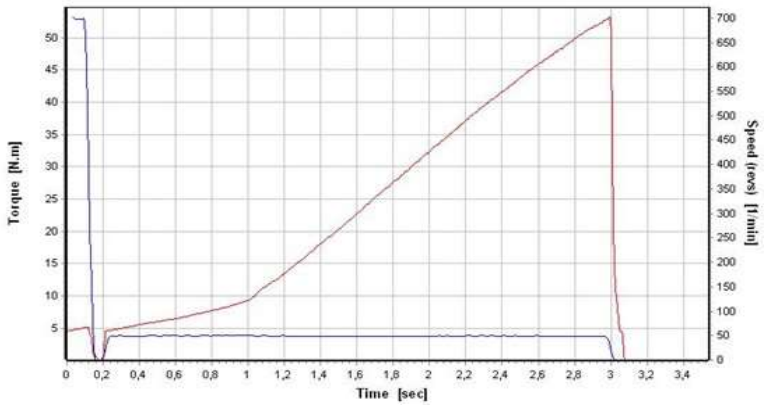
Value no. 1
Graph
Torque / Angle / Speed



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:** 756027

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: 1,00 % ± **0,50 %**

Angle degree: 40° Tolerance: 3,8° ± **1,9°**

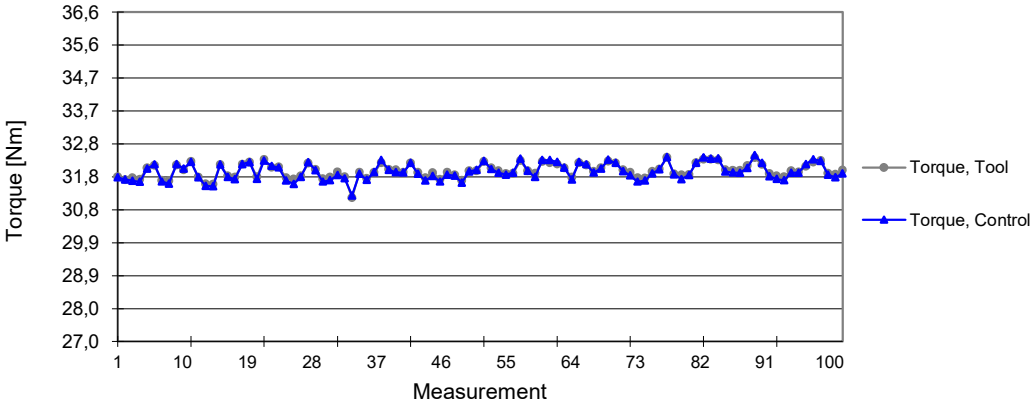
Formula derivation: $C_m = \frac{T}{6\,s}$ $T = C_m * 6\,s$

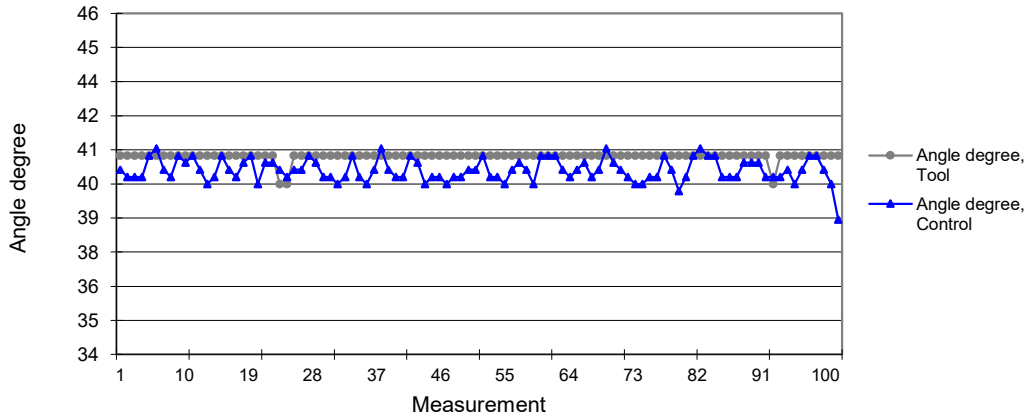
Tool without angle correction

Measurement	Tool data		Control data		Difference	
No.	Torque	Angle	Torque	Angle	Torque	Angle
1	31,80	41,00	31,78	40,50	0,02	0,50
2	31,71	41,00	31,72	40,25	0,01	0,75
3	31,77	41,00	31,68	40,25	0,09	0,75
4	31,72	41,00	31,65	40,25	0,07	0,75
5	32,05	41,00	32,04	41,00	0,01	0,00
6	32,13	41,00	32,16	41,25	0,03	0,25
7	31,69	41,00	31,66	40,50	0,03	0,50
8	31,68	41,00	31,60	40,25	0,08	0,75
9	32,14	41,00	32,17	41,00	0,03	0,00
10	32,00	41,00	32,04	40,75	0,04	0,25
11	32,24	41,00	32,23	41,00	0,01	0,00
12	31,79	41,00	31,78	40,50	0,01	0,50
13	31,59	41,00	31,54	40,00	0,05	1,00
14	31,58	41,00	31,52	40,25	0,06	0,75
15	32,15	41,00	32,15	41,00	0,00	0,00
16	31,82	41,00	31,79	40,50	0,03	0,50
17	31,78	41,00	31,73	40,25	0,05	0,75
18	32,16	41,00	32,17	40,75	0,01	0,25
19	32,22	41,00	32,22	41,00	0,00	0,00
20	31,80	41,00	31,74	40,00	0,06	1,00
21	32,30	41,00	32,27	40,75	0,03	0,25
22	32,07	41,00	32,11	40,75	0,04	0,25
23	32,08	40,00	32,07	40,50	0,01	0,50
24	31,77	40,00	31,69	40,25	0,08	0,25
25	31,73	41,00	31,59	40,50	0,14	0,50
26	31,82	41,00	31,80	40,50	0,02	0,50
27	32,19	41,00	32,22	41,00	0,03	0,00
28	32,01	41,00	31,99	40,75	0,02	0,25
29	31,74	41,00	31,66	40,25	0,08	0,75
30	31,78	41,00	31,70	40,25	0,08	0,75
31	31,94	41,00	31,85	40,00	0,09	1,00
32	31,80	41,00	31,75	40,25	0,05	0,75
33	31,19	41,00	31,26	41,00	0,07	0,00
34	31,93	41,00	31,88	40,25	0,05	0,75
35	31,75	41,00	31,71	40,00	0,04	1,00
36	31,92	41,00	31,93	40,50	0,01	0,50
37	32,21	41,00	32,28	41,25	0,07	0,25
38	32,01	41,00	32,00	40,50	0,01	0,50
39	32,00	41,00	31,93	40,25	0,07	0,75
40	31,93	41,00	31,92	40,25	0,01	0,75
41	32,20	41,00	32,20	41,00	0,00	0,00
42	31,92	41,00	31,89	40,75	0,03	0,25
43	31,77	41,00	31,69	40,00	0,08	1,00
44	31,91	41,00	31,82	40,25	0,09	0,75
45	31,72	41,00	31,66	40,25	0,06	0,75
46	31,93	41,00	31,86	40,00	0,07	1,00
47	31,85	41,00	31,83	40,25	0,02	0,75
48	31,69	41,00	31,63	40,25	0,06	0,75
49	31,97	41,00	31,95	40,50	0,02	0,50
50	31,97	41,00	32,00	40,50	0,03	0,50
51	32,24	41,00	32,26	41,00	0,02	0,00
52	32,05	41,00	32,02	40,25	0,03	0,75
53	31,97	41,00	31,91	40,25	0,06	0,75
54	31,89	41,00	31,86	40,00	0,03	1,00
55	31,90	41,00	31,91	40,50	0,01	0,50
56	32,27	41,00	32,32	40,75	0,05	0,25
57	31,97	41,00	31,97	40,50	0,00	0,50
58	31,90	41,00	31,79	40,00	0,11	1,00
59	32,24	41,00	32,28	41,00	0,04	0,00
60	32,21	41,00	32,28	41,00	0,07	0,00
61	32,17	41,00	32,23	41,00	0,06	0,00
62	32,05	41,00	32,06	40,50	0,01	0,50
63	31,78	41,00	31,72	40,25	0,06	0,75
64	32,21	41,00	32,23	40,50	0,02	0,50
65	32,14	41,00	32,16	40,75	0,02	0,25
66	31,95	41,00	31,92	40,25	0,03	0,75
67	32,06	41,00	32,04	40,50	0,02	0,50
68	32,25	41,00	32,29	41,25	0,04	0,25
69	32,20	41,00	32,20	40,75	0,00	0,25
70	32,00	41,00	31,96	40,50	0,04	0,50
71	31,92	41,00	31,84	40,25	0,08	0,75
72	31,77	41,00	31,66	40,00	0,11	1,00
73	31,76	41,00	31,69	40,00	0,07	1,00
74	31,95	41,00	31,90	40,25	0,05	0,75
75	32,02	41,00	32,01	40,25	0,01	0,75
76	32,36	41,00	32,37	41,00	0,01	0,00
77	31,88	41,00	31,87	40,50	0,01	0,50
78	31,85	41,00	31,73	39,75	0,12	1,25
79	31,86	41,00	31,85	40,25	0,01	0,75
80	32,21	41,00	32,21	41,00	0,00	0,00
81	32,31	41,00	32,36	41,25	0,05	0,25
82	32,31	41,00	32,32	41,00	0,01	0,00
83	32,28	41,00	32,33	41,00	0,05	0,00
84	32,00	41,00	31,95	40,25	0,05	0,75
85	31,98	41,00	31,92	40,25	0,06	0,75
86	31,98	41,00	31,91	40,25	0,07	0,75
87	32,12	41,00	32,05	40,75	0,07	0,25
88	32,35	41,00	32,42	40,75	0,07	0,25
89	32,15	41,00	32,21	40,75	0,06	0,25
90	31,89	41,00	31,81	40,25	0,08	0,75
91	31,82	40,00	31,74	40,25	0,08	0,25
92	31,80	41,00	31,70	40,25	0,10	0,75
93	31,97	41,00	31,91	40,50	0,06	0,50
94	31,94	41,00	31,91	40,00	0,03	1,00
95	32,10	41,00	32,17	40,50	0,07	0,50
96	32,22	41,00	32,31	41,00	0,09	0,00
97	32,27	41,00	32,26	41,00	0,01	0,00
98	31,90	41,00	31,86	40,50	0,04	0,50
99	31,87	41,00	31,78	40,00	0,09	1,00
100	31,99	41,00	31,90	38,75	0,09	2,25
				Standard deviation:	**0,032**	**0,376**

Graphical representation

Model:	**1BD-1B060A-1K2D-1VK2D**	Serial no:	**756027**
Target torque:	**31,80 Nm**	60 % of max. torque	
Angle degree:	**40°**	Tool without angle correction	





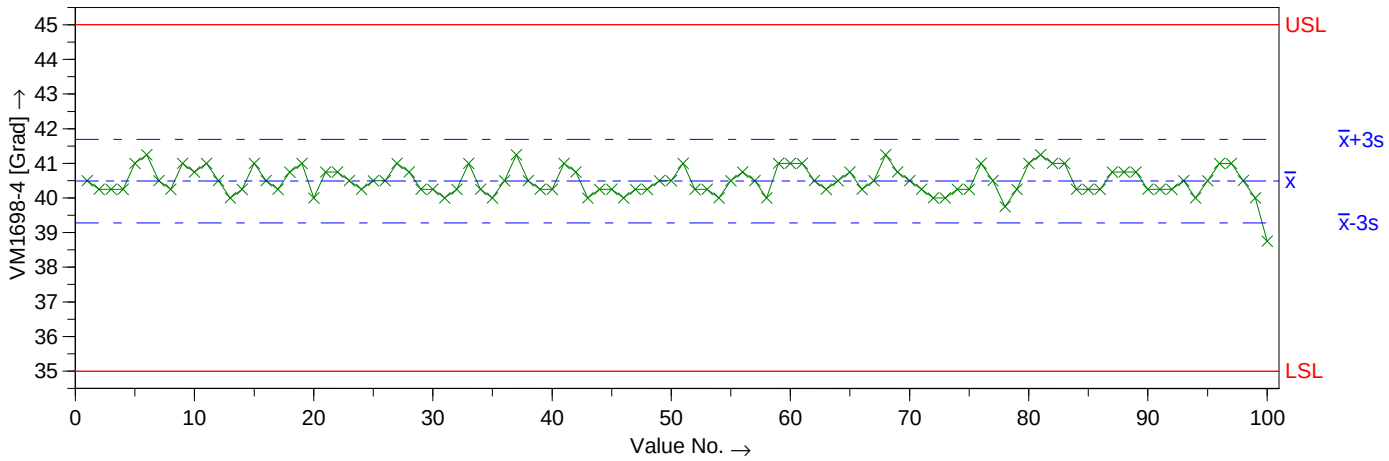
Machine Capability Study
Control System

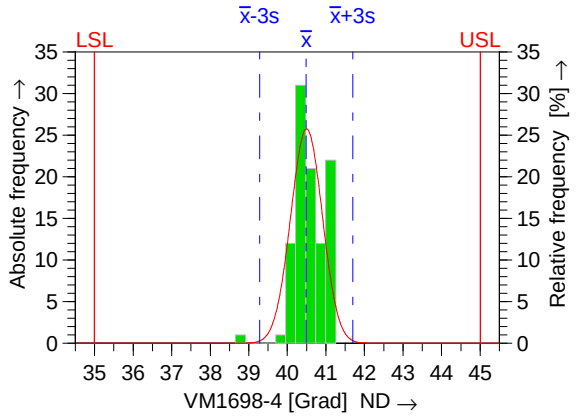
Plant	ATG Westhausen	Operator Name	Sünder
Date	02.02.2022		

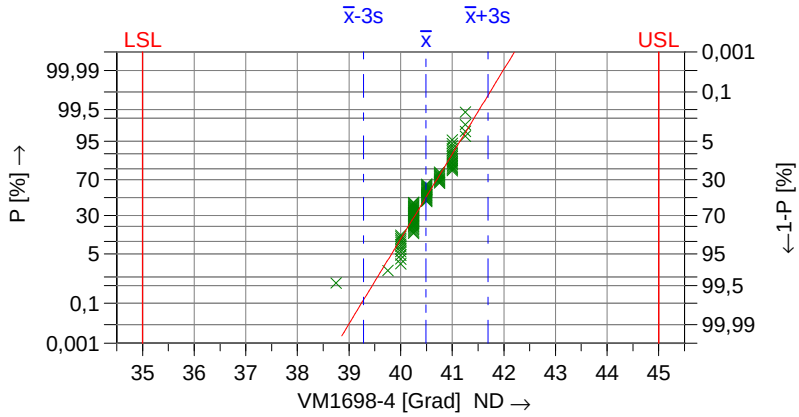
Ord. No.	1BD53T2O-A	Part type	1BD-1B060A-1K2D-1VK2D	Contr.item	yes
Serial No.	756027_k	Char.Descr.	VM1698-4	Inspection Val. 40,00 5,00	USL 45,00
		Serial No.	1024210	Unit Grad -5,00	LSL 35,00
Char.Type	variable			Tolerance value 12 %	Decimal Pl. 2
Cust.Name	Cleco	Reference System	VM1698-4	Test Electronic	MPRO400GCD-P
Contr.No.	Homologation	Reference Transducer	50 / 1024729	nges.	100

Evaluation from 02.02.2022 09:49:07 to 02.02.2022 10:03:16

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			$\bar{x}$	40.4875
LSL	35.00	x_{min}	38.75	$\bar{x}$-3s	39.2797
USL	45.00	x_{max}	41.25	$\bar{x}$+3s	41.6953
T	10.00	R	2.50	6s	2.4156
		$n_{<T>}$	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	4.14
Critical capability index	=	C_{mk}	3.74

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

APEX VDI/VDE 2647 V0.1

Machine Capability Study
Control System

Plant	ATG Westhausen		Operator Name	Sünder	Date 02.02.2022

Ser.No.	756027_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	31,78	31,72	31,68	31,65	32,04	32,16	31,66	31,60	32,17	32,04
1024210	VM1698-4	40,50	40,25	40,25	40,25	41,00	41,25	40,50	40,25	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	32,23	31,78	31,54	31,52	32,15	31,79	31,73	32,17	32,22	31,74
1024210	VM1698-4	41,00	40,50	40,00	40,25	41,00	40,50	40,25	40,75	41,00	40,00

Char.No	Char.Descr.	x_{21}	x_{22}	x_{23}	x_{24}	x_{25}	x_{26}	x_{27}	x_{28}	x_{29}	x_{30}
1024210	VM1698-4	32,27	32,11	32,07	31,69	31,59	31,80	32,22	31,99	31,66	31,70
1024210	VM1698-4	40,75	40,75	40,50	40,25	40,50	40,50	41,00	40,75	40,25	40,25

Char.No	Char.Descr.	x_{31}	x_{32}	x_{33}	x_{34}	x_{35}	x_{36}	x_{37}	x_{38}	x_{39}	x_{40}
1024210	VM1698-4	31,85	31,75	31,26	31,88	31,71	31,93	32,28	32,00	31,93	31,92
1024210	VM1698-4	40,00	40,25	41,00	40,25	40,00	40,50	41,25	40,50	40,25	40,25

Char.No	Char.Descr.	x_{41}	x_{42}	x_{43}	x_{44}	x_{45}	x_{46}	x_{47}	x_{48}	x_{49}	x_{50}
1024210	VM1698-4	32,20	31,89	31,69	31,82	31,66	31,86	31,83	31,63	31,95	32,00
1024210	VM1698-4	41,00	40,75	40,00	40,25	40,25	40,00	40,25	40,25	40,50	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	32,26	32,02	31,91	31,86	31,91	32,32	31,97	31,79	32,28	32,28
1024210	VM1698-4	41,00	40,25	40,25	40,00	40,50	40,75	40,50	40,00	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}
1024210	VM1698-4	32,23	32,06	31,72	32,23	32,16	31,92	32,04	32,29	32,20	31,96
1024210	VM1698-4	41,00	40,50	40,25	40,50	40,75	40,25	40,50	41,25	40,75	40,50

Char.No	Char.Descr.	x_{71}	x_{72}	x_{73}	x_{74}	x_{75}	x_{76}	x_{77}	x_{78}	x_{79}	x_{80}
1024210	VM1698-4	31,84	31,66	31,69	31,90	32,01	32,37	31,87	31,73	31,85	32,21
1024210	VM1698-4	40,25	40,00	40,00	40,25	40,25	41,00	40,50	39,75	40,25	41,00

Machine Capability Study
Control System

Plant	ATG Westhausen		Operator Name	Sünder	Date 02.02.2022

Ser.No.	756027_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	32,36	32,32	32,33	31,95	31,92	31,91	32,05	32,42	32,21	31,81
1024210	VM1698-4	41,25	41,00	41,00	40,25	40,25	40,25	40,75	40,75	40,75	40,25

Char.No	Char.Descr.	x_{91}	x_{92}	x_{93}	x_{94}	x_{95}	x_{96}	x_{97}	x_{98}	x_{99}	x_{100}
1024210	VM1698-4	31,74	31,70	31,91	31,91	32,17	32,31	32,26	31,86	31,78	31,90
1024210	VM1698-4	40,25	40,25	40,50	40,00	40,50	41,00	41,00	40,50	40,00	38,75

Machine Capability Study
Tool System

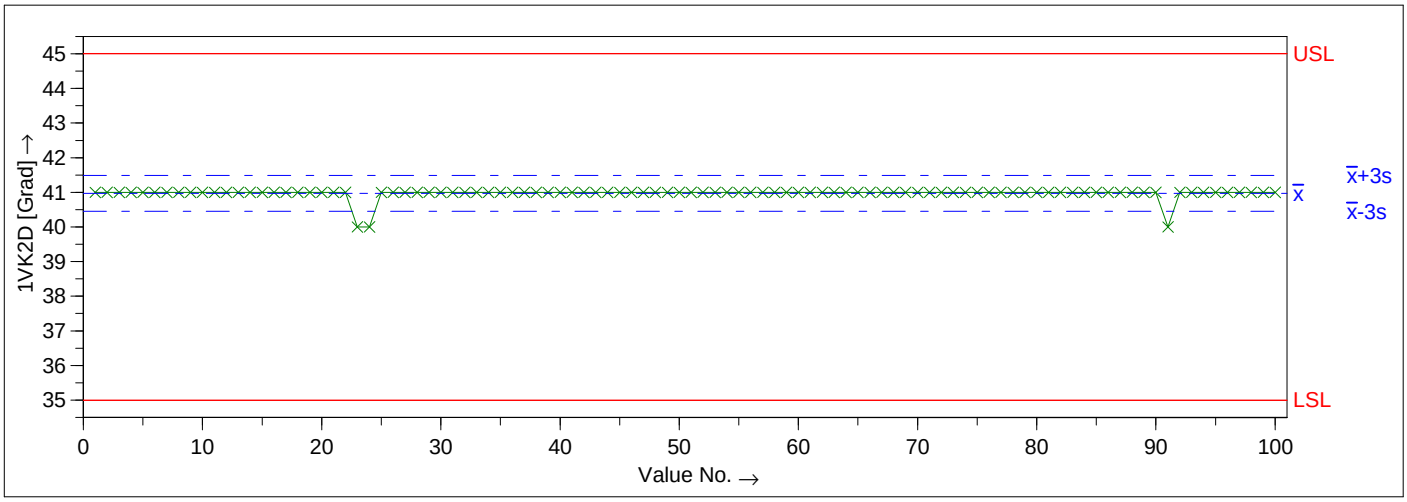
Page 1 / 1

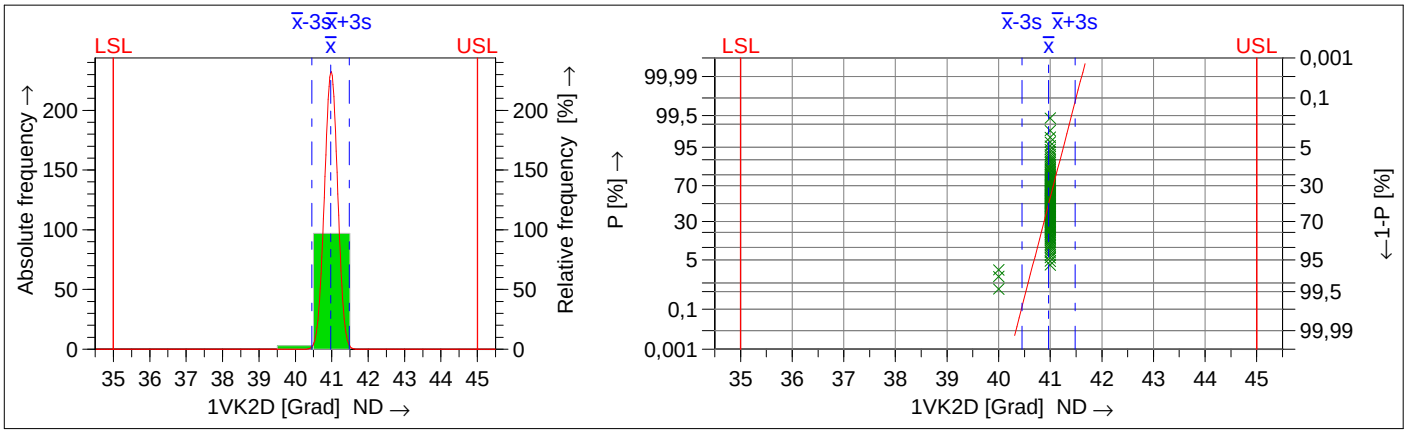
Plant	ATG Westhausen	Operator Name	Sünder
Date	02.02.2022		

Ord. No.	1BD53T2O-A	Part type	1BD-1B060A-1K2D-1VK2D	Contr.item	yes
Serial No.	756027_k	Char.Descr.	1VK2D	Inspection Val. 40,00 5,00	USL 45,00
		Serial No.	200692_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 02.02.2022 09:49:08 to 02.02.2022 10:03:16

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			$\bar{x}$	40.9700
LSL	35.00	x_{min}	40.00	$\bar{x}$-3s	40.4557
USL	45.00	x_{max}	41.00	$\bar{x}$+3s	41.4843
T	10.00	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	9.72
Critical capability index	=	C_{mk}	7.84

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 02.02.2022

Ser.No.	756027_k	Characteristic			
Type	1BD-1B060A-1K2D-1VK2D	Char.Descr.	1VK2D	Inspection Val.	31,80
Ord. No.	1BD53T2O-A	Ser.No.	200692_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}
200692_	1VK2D	31,80	31,71	31,77	31,72	32,05	32,13	31,69	31,68	32,14	32,00
200692_	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}
200692_	1VK2D	32,24	31,79	31,59	31,58	32,15	31,82	31,78	32,16	32,22	31,80
200692_	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}
200692_	1VK2D	32,30	32,07	32,08	31,77	31,73	31,82	32,19	32,01	31,74	31,78
200692_	1VK2D	41,00	41,00	40,00	40,00	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}
200692_	1VK2D	31,94	31,80	31,19	31,93	31,75	31,92	32,21	32,01	32,00	31,93
200692_	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}
200692_	1VK2D	32,20	31,92	31,77	31,91	31,72	31,93	31,85	31,69	31,97	31,97
200692_	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}
200692_	1VK2D	32,24	32,05	31,97	31,89	31,90	32,27	31,97	31,90	32,24	32,21
200692_	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}
200692_	1VK2D	32,17	32,05	31,78	32,21	32,14	31,95	32,06	32,25	32,20	32,00
200692_	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}
200692_	1VK2D	31,92	31,77	31,76	31,95	32,02	32,36	31,88	31,85	31,86	32,21
200692_	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 02.02.2022

Ser.No.	756027_k	Characteristic			
Type	1BD-1B060A-1K2D-1VK2D	Char.Descr.	1VK2D	Inspection Val.	31,80
Ord. No.	1BD53T2O-A	Ser.No.	200692_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}
200692_	1VK2D	32,31	32,31	32,28	32,00	31,98	31,98	32,12	32,35	32,15	31,89
200692_	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}
200692_	1VK2D	31,82	31,80	31,97	31,94	32,10	32,22	32,27	31,90	31,87	31,99
200692_	1VK2D	40,00	41,00	41,00	41,00	41,00	41,00	41,00	41,00	41,00	41,00

Machine Capability Study
Tool System

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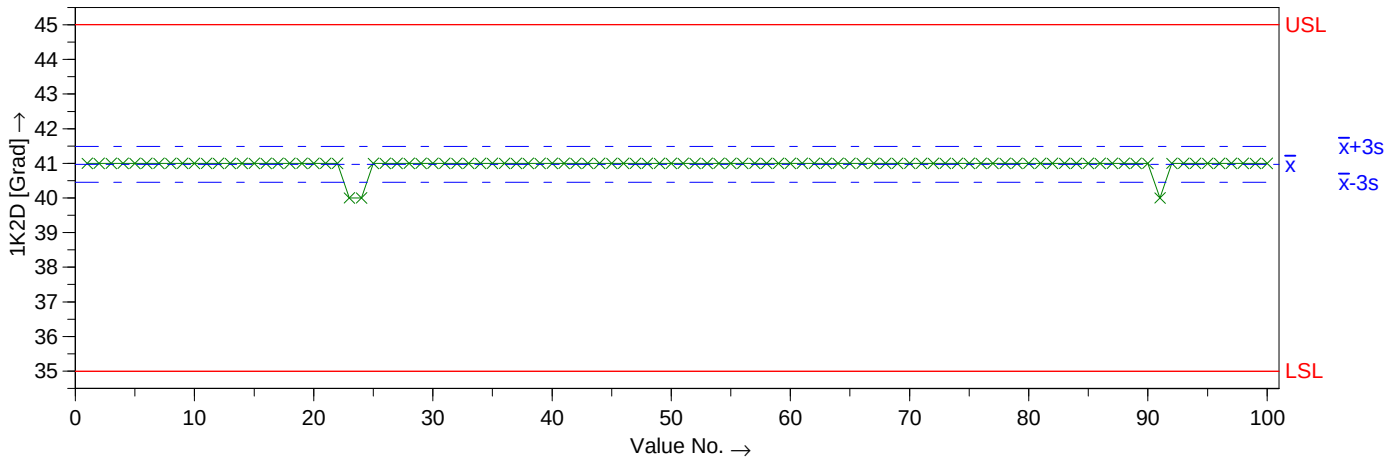
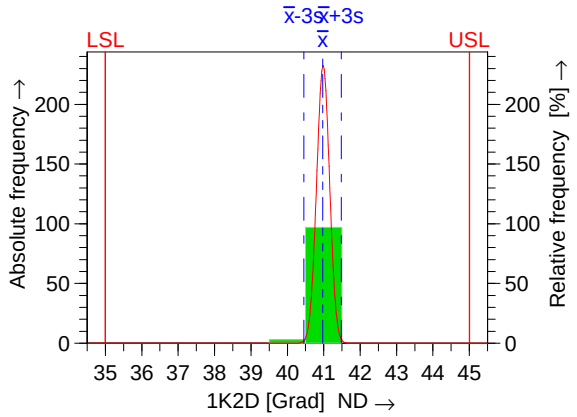
Plant	ATG Westhausen	Operator Name	Sünder
Date	02.02.2022		

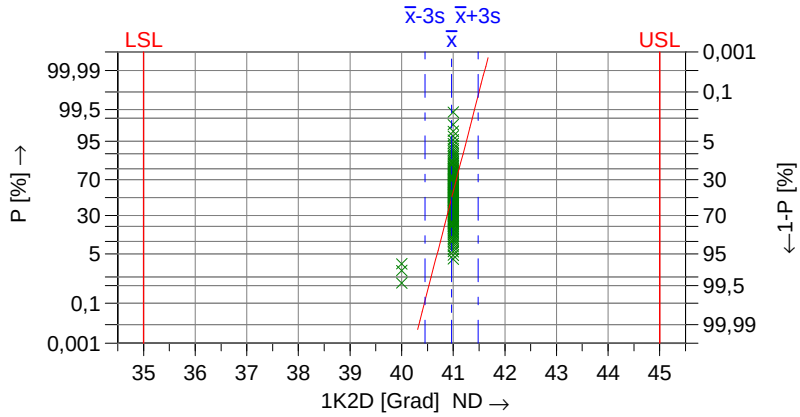
Ord. No.	1BD53T2O-A	Part type	1BD-1B060A-1K2D-1VK2D	Contr.item	yes
Serial No.	756027_k	Char.Descr.	1K2D	Inspection Val. 40,00 5,00	USL 45,00
		Serial No.	202851	Unit Grad -5,00	LSL 35,00
Char.Type	variable			Tolerance value 12 %	Decimal Pl. 2
Cust.Name	Cleco	Reference System	VM1698-4	Test Electronic	MPRO400GCD-P
Contr.No.	Homologation	Reference Transducer	50 / 1024729	nges.	100

Evaluation from 02.02.2022 09:49:08 to 02.02.2022 10:03:16

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			$\bar{x}$	40.9700
LSL	35.00	x_{min}	40.00	$\bar{x}$-3s	40.4557
USL	45.00	x_{max}	41.00	$\bar{x}$+3s	41.4843
T	10.00	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	9.72
Critical capability index	=	C_{mk}	7.84

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 02.02.2022

Ser.No.	756027_k	Characteristic			
Type	1BD-1B060A-1K2D-1VK2D	Char.Descr.	1K2D	Inspection Val.	31,80
Ord. No.	1BD53T2O-A	Ser.No.	202851	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}
202851	1K2D	31,89	31,72	31,78	31,46	32,17	32,06	31,56	31,70	32,27	32,00
202851	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}
202851	1K2D	32,06	31,92	31,31	31,58	32,23	31,65	31,90	32,37	32,23	31,60
202851	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}
202851	1K2D	32,44	32,17	32,16	31,76	31,57	31,58	31,99	32,08	31,50	31,56
202851	1K2D	41,00	41,00	40,00	40,00	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}
202851	1K2D	31,69	31,57	31,14	31,71	31,67	31,64	32,24	32,21	31,85	31,69
202851	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}
202851	1K2D	31,98	31,88	31,79	31,90	31,74	31,81	31,88	31,43	32,09	32,03
202851	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}
202851	1K2D	32,34	31,91	31,76	31,92	31,73	32,35	31,90	31,56	32,10	32,43
202851	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}
202851	1K2D	31,96	32,23	31,71	32,01	32,23	32,05	32,15	32,16	31,97	31,96
202851	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}
202851	1K2D	31,68	31,90	31,67	31,75	32,21	32,16	31,67	31,48	31,97	31,98
202851	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 02.02.2022

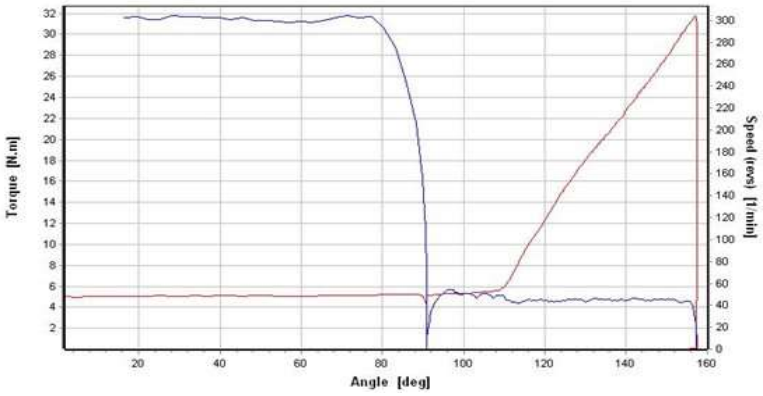
Ser.No.	756027_k	Characteristic			
Type	1BD-1B060A-1K2D-1VK2D	Char.Descr.	1K2D	Inspection Val.	31,80
Ord. No.	1BD53T2O-A	Ser.No.	202851	LSL	29,57
				USL	34,03
Remark	TQ 60% Angle 40°+/-5°* TQ-Cal.: 60.0 Nm; Cu r-Cal.: 3.8391 Nm/A; Speed: 300/50 rpm;				

Char.No	Char.Descr.	x_{81}	x_{82}	x_{83}	x_{84}	x_{85}	x_{86}	x_{87}	x_{88}	x_{89}	x_{90}
202851	1K2D	32,39	32,45	32,19	31,98	31,82	31,61	31,84	32,38	32,28	31,79
202851	1K2D	41,00	41,00	41,00	41,00	41,00	41,00	41,00	41,00	41,00	41,00

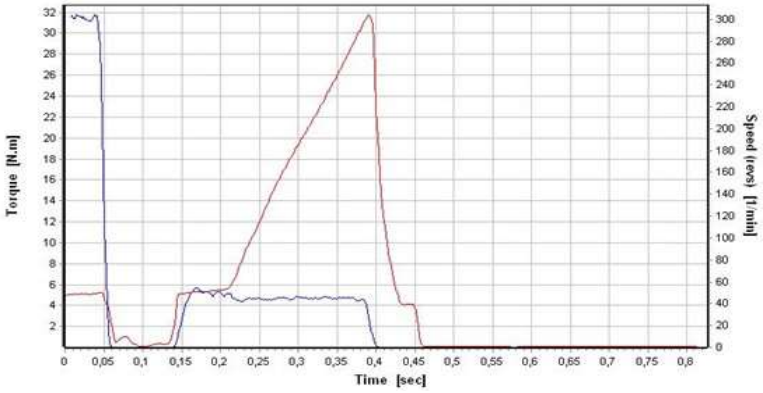
Char.No	Char.Descr.	x_{91}	x_{92}	x_{93}	x_{94}	x_{95}	x_{96}	x_{97}	x_{98}	x_{99}	x_{100}
202851	1K2D	31,87	31,43	32,00	32,02	31,95	32,36	32,21	31,71	31,61	32,03
202851	1K2D	40,00	41,00	41,00	41,00	41,00	41,00	41,00	41,00	41,00	41,00

Torque graphs

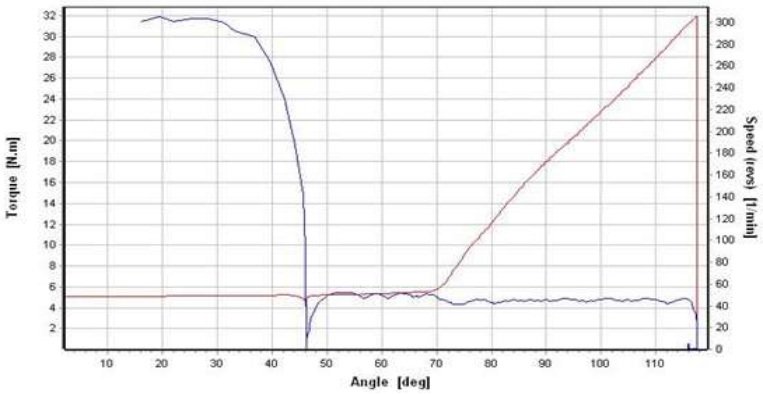
Model:	**1BD-1B060A-1K2D-1VK2D**	Serial no:	**756027**
Target torque:	**31,80 Nm**	60 % of max. torque	
Angle degree:	**40°**	Tool without angle correction	



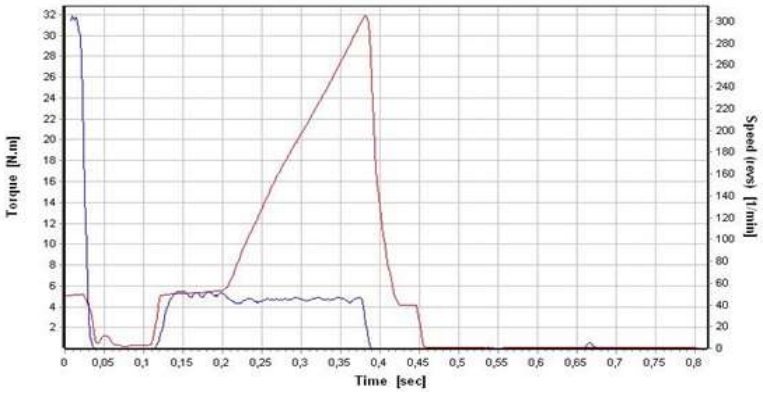
Value no. 1
Graph
Torque / Angle / Speed



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:** 756027

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: 0,95 % ± **0,47 %**

Angle degree: 180° Tolerance: 6,9° ± **3,5°**

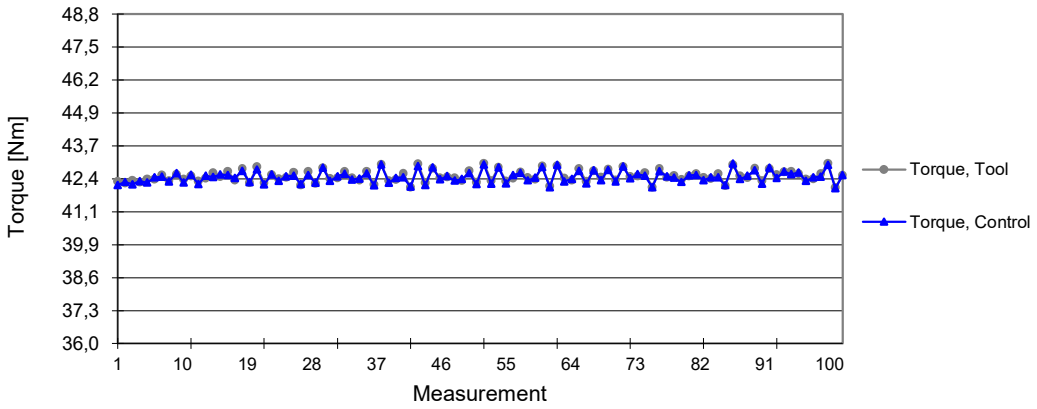
Formula derivation: $C_m = \frac{T}{6\,s}$ $T = C_m * 6\,s$

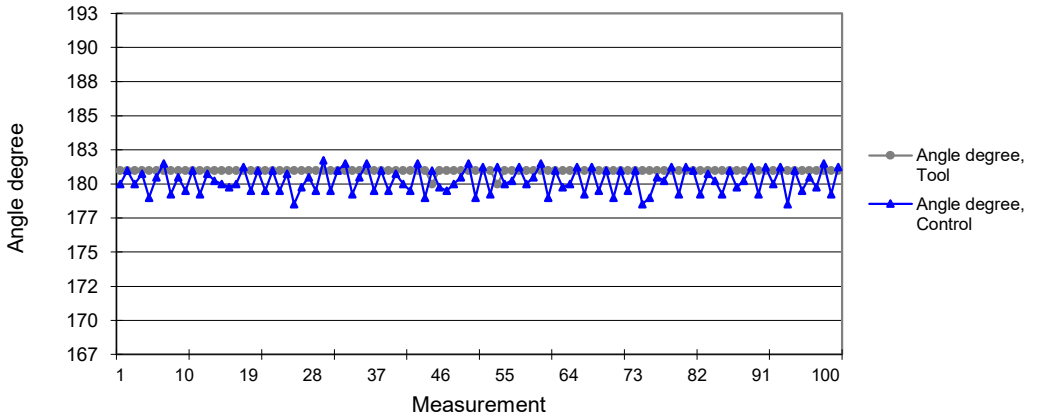
Tool without angle correction

Measurement	Tool data		Control data		Difference	
No.	Torque	Angle	Torque	Angle	Torque	Angle
1	42,30	181,00	42,16	180,00	0,14	1,00
2	42,23	181,00	42,27	181,00	0,04	0,00
3	42,34	181,00	42,18	180,00	0,16	1,00
4	42,26	181,00	42,31	180,75	0,05	0,25
5	42,39	181,00	42,25	179,00	0,14	2,00
6	42,38	181,00	42,45	180,50	0,07	0,50
7	42,54	181,00	42,48	181,50	0,06	0,50
8	42,33	181,00	42,29	179,25	0,04	1,75
9	42,56	181,00	42,61	180,50	0,05	0,50
10	42,38	181,00	42,25	179,50	0,13	1,50
11	42,50	181,00	42,55	181,00	0,05	0,00
12	42,31	181,00	42,19	179,25	0,12	1,75
13	42,42	181,00	42,51	180,75	0,09	0,25
14	42,62	181,00	42,47	180,25	0,15	0,75
15	42,48	181,00	42,56	180,00	0,08	1,00
16	42,69	181,00	42,54	179,75	0,15	1,25
17	42,35	181,00	42,43	180,00	0,08	1,00
18	42,79	181,00	42,71	181,25	0,08	0,25
19	42,24	181,00	42,26	179,50	0,02	1,50
20	42,86	181,00	42,76	181,00	0,10	0,00
21	42,24	181,00	42,18	179,50	0,06	1,50
22	42,55	181,00	42,56	181,00	0,01	0,00
23	42,40	181,00	42,32	179,50	0,08	1,50
24	42,45	181,00	42,49	180,75	0,04	0,25
25	42,64	181,00	42,52	178,50	0,12	2,50
26	42,15	181,00	42,19	179,75	0,04	1,25
27	42,67	181,00	42,54	180,50	0,13	0,50
28	42,21	181,00	42,24	179,50	0,03	1,50
29	42,82	181,00	42,83	181,75	0,01	0,75
30	42,41	181,00	42,32	179,50	0,09	1,50
31	42,43	181,00	42,49	181,00	0,06	0,00
32	42,67	181,00	42,59	181,50	0,08	0,50
33	42,43	181,00	42,37	179,25	0,06	1,75
34	42,35	181,00	42,41	180,50	0,06	0,50
35	42,68	181,00	42,60	181,50	0,08	0,50
36	42,17	181,00	42,14	179,50	0,03	1,50
37	42,95	181,00	42,95	181,00	0,00	0,00
38	42,33	181,00	42,24	179,50	0,09	1,50
39	42,37	181,00	42,43	180,75	0,06	0,25
40	42,60	181,00	42,46	180,00	0,14	1,00
41	42,07	181,00	42,09	179,50	0,02	1,50
42	42,97	181,00	42,89	181,50	0,08	0,50
43	42,24	181,00	42,15	179,00	0,09	2,00
44	42,80	180,00	42,84	181,00	0,04	1,00
45	42,43	181,00	42,38	179,75	0,05	1,25
46	42,47	181,00	42,50	179,50	0,03	1,50
47	42,43	181,00	42,33	180,00	0,10	1,00
48	42,33	181,00	42,39	180,50	0,06	0,50
49	42,71	181,00	42,61	181,50	0,10	0,50
50	42,26	181,00	42,19	179,00	0,07	2,00
51	42,99	181,00	42,95	181,25	0,04	0,25
52	42,33	181,00	42,20	179,25	0,13	1,75
53	42,84	180,00	42,84	181,25	0,00	1,25
54	42,31	181,00	42,22	180,00	0,09	1,00
55	42,42	181,00	42,54	180,25	0,12	0,75
56	42,65	181,00	42,62	181,25	0,03	0,25
57	42,44	181,00	42,34	180,00	0,10	1,00
58	42,38	181,00	42,44	180,50	0,06	0,50
59	42,89	181,00	42,85	181,50	0,04	0,50
60	42,11	181,00	42,07	179,00	0,04	2,00
61	42,90	181,00	42,93	181,00	0,03	0,00
62	42,42	181,00	42,30	179,75	0,12	1,25
63	42,34	181,00	42,40	180,00	0,06	1,00
64	42,79	181,00	42,71	181,25	0,08	0,25
65	42,29	181,00	42,21	179,25	0,08	1,75
66	42,71	181,00	42,73	181,25	0,02	0,25
67	42,46	181,00	42,35	179,50	0,11	1,50
68	42,77	181,00	42,74	181,00	0,03	0,00
69	42,35	181,00	42,29	179,00	0,06	2,00
70	42,87	181,00	42,87	181,00	0,00	0,00
71	42,48	181,00	42,42	179,50	0,06	1,50
72	42,50	181,00	42,57	181,00	0,07	0,00
73	42,63	181,00	42,52	178,50	0,11	2,50
74	42,07	181,00	42,07	179,00	0,00	2,00
75	42,79	181,00	42,68	180,50	0,11	0,50
76	42,45	181,00	42,49	180,25	0,04	0,75
77	42,52	181,00	42,44	181,25	0,08	0,25
78	42,37	181,00	42,27	179,25	0,10	1,75
79	42,50	181,00	42,53	181,25	0,03	0,25
80	42,59	181,00	42,54	181,00	0,05	0,00
81	42,45	181,00	42,35	179,25	0,10	1,75
82	42,41	181,00	42,45	180,75	0,04	0,25
83	42,59	181,00	42,45	180,25	0,14	0,75
84	42,13	181,00	42,15	179,25	0,02	1,75
85	42,94	181,00	42,98	181,00	0,04	0,00
86	42,51	181,00	42,39	179,75	0,12	1,25
87	42,44	181,00	42,51	180,25	0,07	0,75
88	42,80	181,00	42,73	181,25	0,07	0,25
89	42,33	181,00	42,20	179,25	0,13	1,75
90	42,79	181,00	42,83	181,25	0,04	0,25
91	42,55	181,00	42,43	180,00	0,12	1,00
92	42,66	181,00	42,67	181,25	0,01	0,25
93	42,69	181,00	42,57	178,50	0,12	2,50
94	42,59	181,00	42,64	181,00	0,05	0,00
95	42,39	181,00	42,32	179,50	0,07	1,50
96	42,40	181,00	42,46	180,50	0,06	0,50
97	42,59	181,00	42,48	179,75	0,11	1,25
98	42,99	181,00	42,94	181,50	0,05	0,50
99	42,06	181,00	42,03	179,25	0,03	1,75
100	42,53	181,00	42,54	181,25	0,01	0,25
				Standard deviation:	**0,040**	**0,693**

Graphical representation

Model:	**1BD-1B060A-1K2D-1VK2D**	Serial no:	**756027**
Target torque:	**42,40 Nm**	80 % of max. torque	
Angle degree:	**180°**	Tool without angle correction	





Machine Capability Study
Control System

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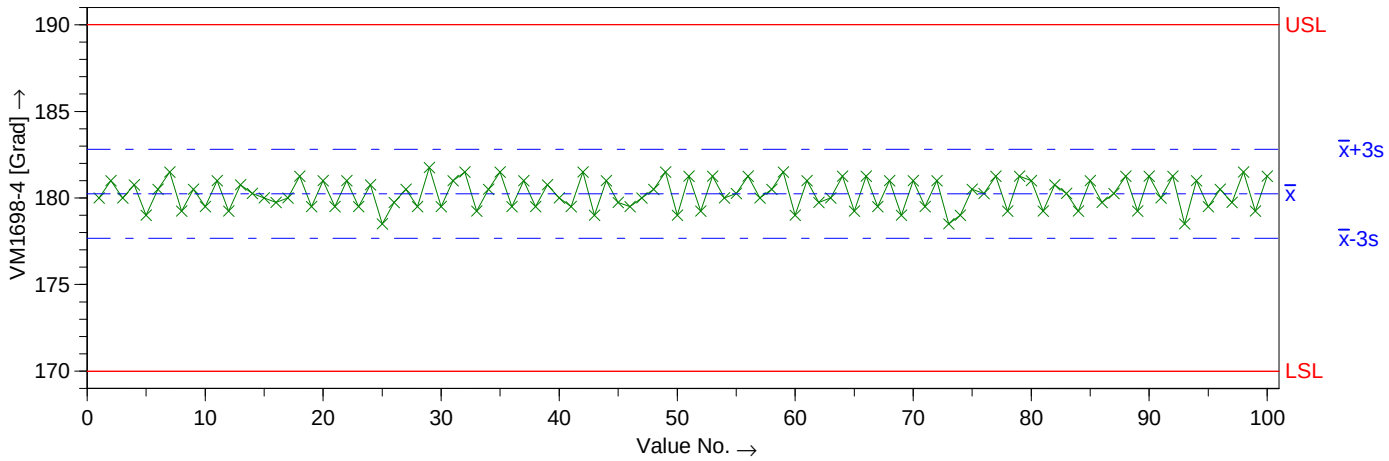
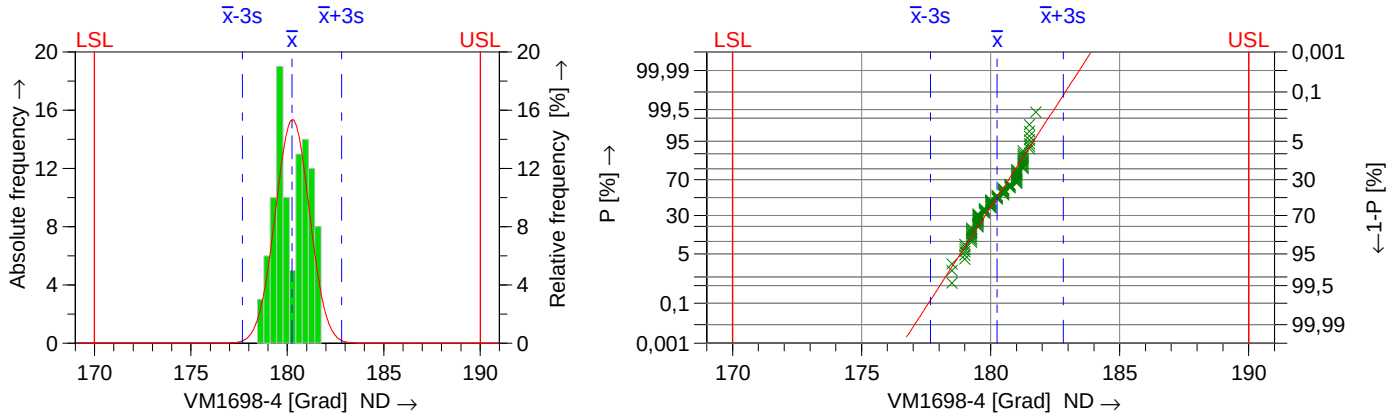
Plant	ATG Westhausen	Operator Name	Sünder
Date	02.02.2022		

Ord. No.	1BD53T2O-A	Part type	1BD-1B060A-1K2D-1VK2D	Contr.item	yes
Serial No.	756027_l	Char.Descr.	VM1698-4	Inspection Val. 180,00 10,00	USL 190,00
		Serial No.	1024210	Unit Grad -10,00	LSL 170,00
Char.Type	variable			Tolerance value 6 %	Decimal Pl. 2
Cust.Name	Cleco	Reference System	VM1698-4	Test Electronic	MPRO400GCD-P
Contr.No.	Homologation	Reference Transducer	50 / 1024729	nges.	100

Evaluation from 02.02.2022 10:04:43 to 02.02.2022 10:20:31

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			$\bar{x}$	180.2425
LSL	170.00	x_{min}	178.50	$\bar{x}$-3s	177.6698
USL	190.00	x_{max}	181.75	$\bar{x}$+3s	182.8152
T	20.00	R	3.25	6s	5.1454
		$n_{<T>}$	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	3.89
Critical capability index	=	C_{mk}	3.79

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

APEX VDI/VDE 2647 V0.1

Apex Tool Group GmbH \\htwe0006\AppData\QW\QWE\MessWert\2022\756027_lM.DFD

Machine Capability Study
Control System

Plant	ATG Westhausen		Operator Name	Sünder	Date 02.02.2022

Ser.No.	756027_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	42,16	42,27	42,18	42,31	42,25	42,45	42,48	42,29	42,61	42,25
1024210	VM1698-4	180,00	181,00	180,00	180,75	179,00	180,50	181,50	179,25	180,50	179,50

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	42,55	42,19	42,51	42,47	42,56	42,54	42,43	42,71	42,26	42,76
1024210	VM1698-4	181,00	179,25	180,75	180,25	180,00	179,75	180,00	181,25	179,50	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}
1024210	VM1698-4	42,18	42,56	42,32	42,49	42,52	42,19	42,54	42,24	42,83	42,32
1024210	VM1698-4	179,50	181,00	179,50	180,75	178,50	179,75	180,50	179,50	181,75	179,50

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	42,49	42,59	42,37	42,41	42,60	42,14	42,95	42,24	42,43	42,46
1024210	VM1698-4	181,00	181,50	179,25	180,50	181,50	179,50	181,00	179,50	180,75	180,00

Char.No	Char.Descr.	x_{41}	x_{42}	x_{43}	x_{44}	x_{45}	x_{46}	x_{47}	x_{48}	x_{49}	x_{50}
1024210	VM1698-4	42,09	42,89	42,15	42,84	42,38	42,50	42,33	42,39	42,61	42,19
1024210	VM1698-4	179,50	181,50	179,00	181,00	179,75	179,50	180,00	180,50	181,50	179,00

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	42,95	42,20	42,84	42,22	42,54	42,62	42,34	42,44	42,85	42,07
1024210	VM1698-4	181,25	179,25	181,25	180,00	180,25	181,25	180,00	180,50	181,50	179,00

Char.No	Char.Descr.	x_{61}	x_{62}	x_{63}	x_{64}	x_{65}	x_{66}	x_{67}	x_{68}	x_{69}	x_{70}
1024210	VM1698-4	42,93	42,30	42,40	42,71	42,21	42,73	42,35	42,74	42,29	42,87
1024210	VM1698-4	181,00	179,75	180,00	181,25	179,25	181,25	179,50	181,00	179,00	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}
1024210	VM1698-4	42,42	42,57	42,52	42,07	42,68	42,49	42,44	42,27	42,53	42,54
1024210	VM1698-4	179,50	181,00	178,50	179,00	180,50	180,25	181,25	179,25	181,25	181,00

Machine Capability Study
Control System

Plant	ATG Westhausen		Operator Name	Sünder	Date 02.02.2022

Ser.No.	756027_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	42,35	42,45	42,45	42,15	42,98	42,39	42,51	42,73	42,20	42,83
1024210	VM1698-4	179,25	180,75	180,25	179,25	181,00	179,75	180,25	181,25	179,25	181,25

Char.No	Char.Descr.	x_{91}	x_{92}	x_{93}	x_{94}	x_{95}	x_{96}	x_{97}	x_{98}	x_{99}	x_{100}
1024210	VM1698-4	42,43	42,67	42,57	42,64	42,32	42,46	42,48	42,94	42,03	42,54
1024210	VM1698-4	180,00	181,25	178,50	181,00	179,50	180,50	179,75	181,50	179,25	181,25

Machine Capability Study
Tool System

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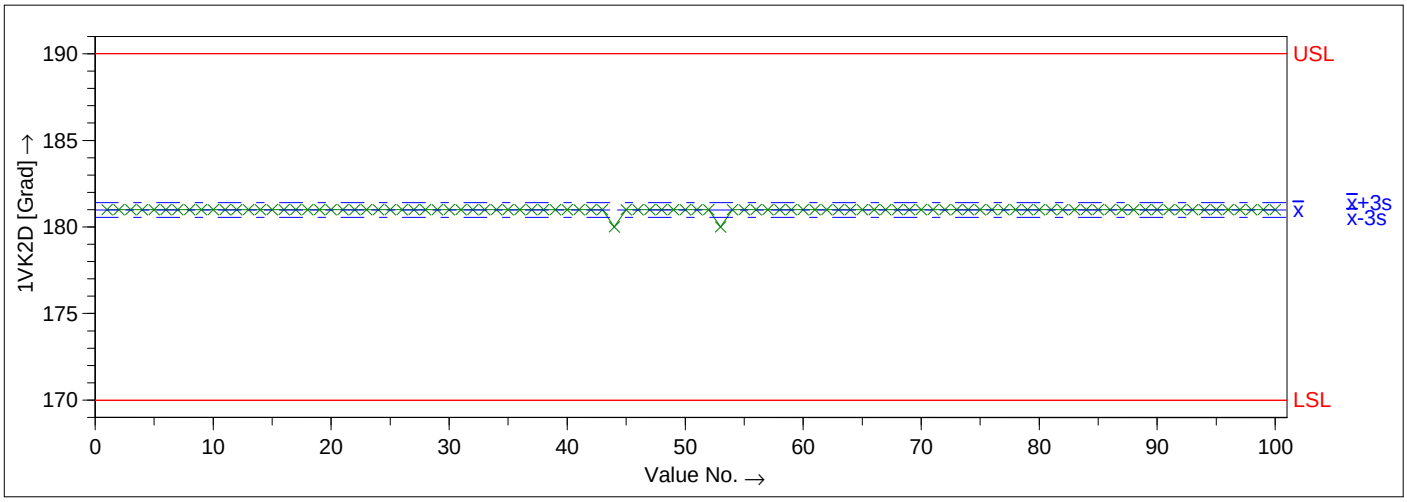
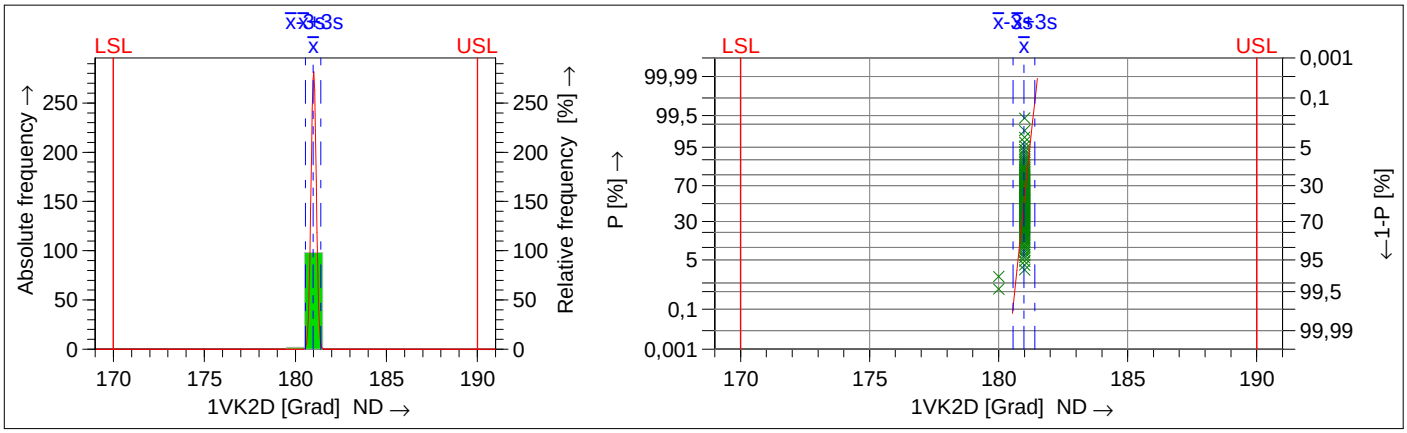
Plant ATG Westhausen		Operator Name Sünder	Date 02.02.2022

Ord. No. 1BD53T2O-A	Part type 1BD-1B060A-1K2D-1VK2D				Contr.item yes
Serial No. 756027_l	Char.Descr. 1VK2D	Inspection Val. 180,00	10,00	USL 190,00	
	Serial No. 200692_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 02.02.2022 10:04:44 to 02.02.2022 10:20:31

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			$\bar{x}$	180.9800
LSL	170.00	x_{min}	180.00	$\bar{x}$-3s	180.5579
USL	190.00	x_{max}	181.00	$\bar{x}$+3s	181.4021
T	20.00	R	1.00	6s	0.8442
		$n_{<T>}$	100	$p_{<T>}$	100.00000 %
		$n_{>USL}$	0	$p_{>USL}$	0.00000%
		$n_{<LSL}$	0	$p_{<LSL}$	0.00000%
		n_{eff}	100		
		n_{tot}	100		

Model distribution			Normal Distribution
Calculation method			$M1_{1,4}$ $\hat{\sigma} = s_{tot}$
Potential Capability index	=	C_m	23.69
Critical capability index	=	C_{mk}	21.37

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

APEX VDI/VDE 2647 V0.1

Machine Capability Study
Tool System

Plant	ATG Westhausen		Operator Name	Sünder	Date 02.02.2022

Ser.No.	756027_l	Characteristic			
Type	1BD-1B060A-1K2D-1VK2D	Char.Descr.	1VK2D	Inspection Val.	42,40
Ord. No.	1BD53T2O-A	Ser.No.	200692_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}
200692_	1VK2D	42,30	42,23	42,34	42,26	42,39	42,38	42,54	42,33	42,56	42,38
200692_	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}
200692_	1VK2D	42,50	42,31	42,42	42,62	42,48	42,69	42,35	42,79	42,24	42,86
200692_	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}
200692_	1VK2D	42,24	42,55	42,40	42,45	42,64	42,15	42,67	42,21	42,82	42,41
200692_	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}
200692_	1VK2D	42,43	42,67	42,43	42,35	42,68	42,17	42,95	42,33	42,37	42,60
200692_	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_{41}	x_{42}	x_{43}	x_{44}	x_{45}	x_{46}	x_{47}	x_{48}	x_{49}	x_{50}
200692_	1VK2D	42,07	42,97	42,24	42,80	42,43	42,47	42,43	42,33	42,71	42,26
200692_	1VK2D	181,00	181,00	181,00	180,00	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}
200692_	1VK2D	42,99	42,33	42,84	42,31	42,42	42,65	42,44	42,38	42,89	42,11
200692_	1VK2D	181,00	181,00	180,00	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}
200692_	1VK2D	42,90	42,42	42,34	42,79	42,29	42,71	42,46	42,77	42,35	42,87
200692_	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}
200692_	1VK2D	42,48	42,50	42,63	42,07	42,79	42,45	42,52	42,37	42,50	42,59
200692_	1VK2D	181,00	181,00	181,00	181,00	181,00	181,00	181,00	181,00	181,00	181,00

Machine Capability Study
Tool System

Plant	ATG Westhausen		Operator Name	Sünder	Date 02.02.2022

Ser.No.	756027_l	Characteristic			
Type	1BD-1B060A-1K2D-1VK2D	Char.Descr.	1VK2D	Inspection Val.	42,40
Ord. No.	1BD53T2O-A	Ser.No.	200692_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}
200692_	1VK2D	42,45	42,41	42,59	42,13	42,94	42,51	42,44	42,80	42,33	42,79
200692_	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}
200692_	1VK2D	42,55	42,66	42,69	42,59	42,39	42,40	42,59	42,99	42,06	42,53
200692_	1VK2D	181,00	181,00	181,00	181,00	181,00	181,00	181,00	181,00	181,00	181,00

Machine Capability Study
Tool System

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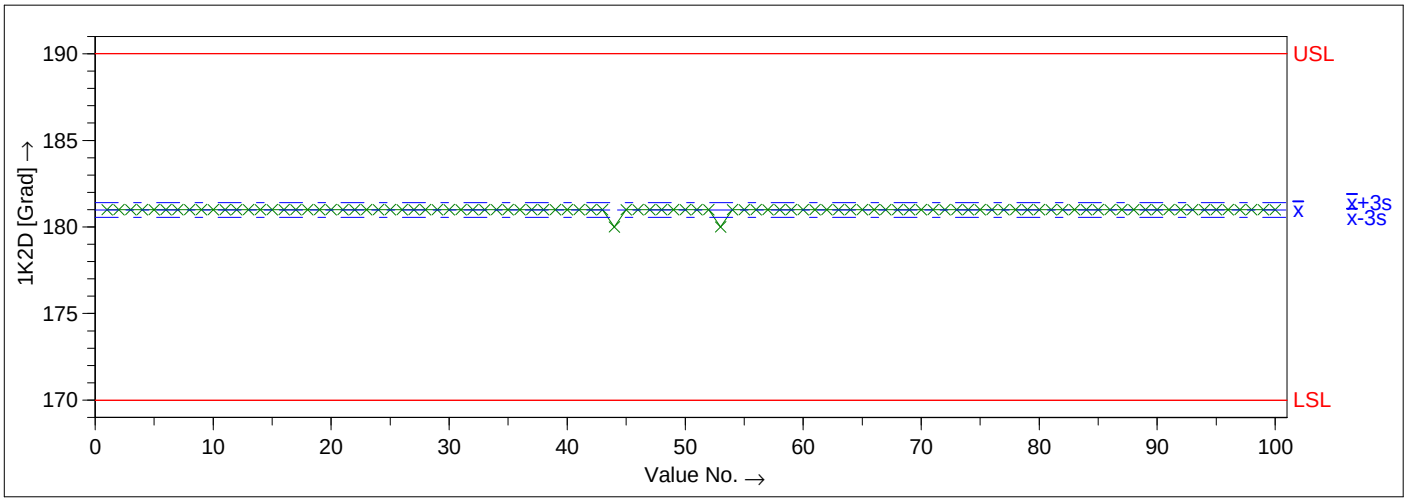
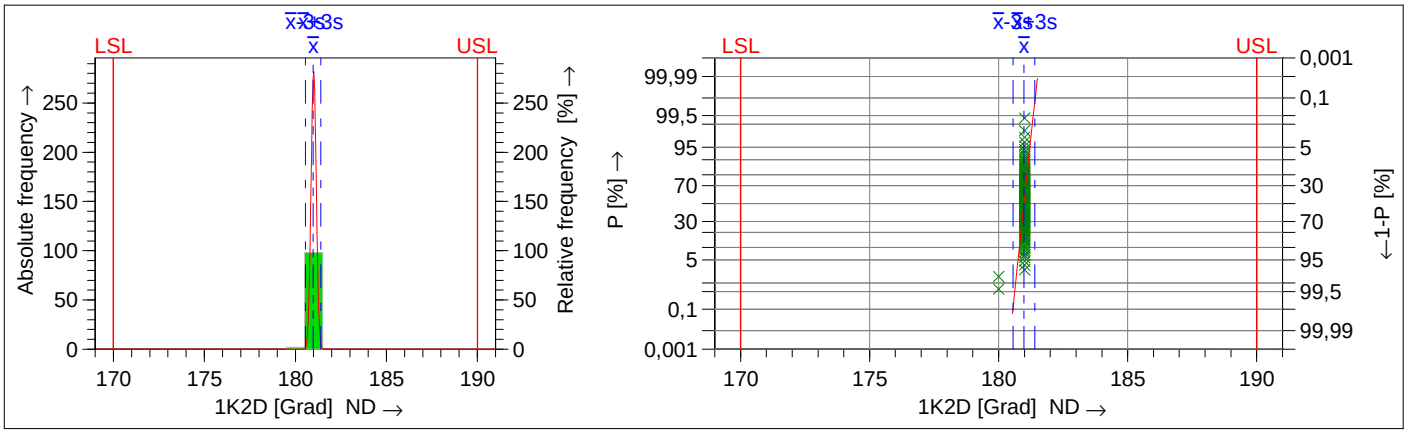
Plant	ATG Westhausen	Operator Name	Sünder
Date	02.02.2022		

Ord. No.	1BD53T2O-A	Part type	1BD-1B060A-1K2D-1VK2D	Contr.item	yes
Serial No.	756027_l	Char.Descr.	1K2D	Inspection Val. 180,00 10,00	USL 190,00
		Serial No.	202851	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 02.02.2022 10:04:44 to 02.02.2022 10:20:31

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			$\bar{x}$	180.9800
LSL	170.00	x_{min}	180.00	$\bar{x}$-3s	180.5579
USL	190.00	x_{max}	181.00	$\bar{x}$+3s	181.4021
T	20.00	R	1.00	6s	0.8442
		$n_{<T>}$	100	$p_{<T>}$	100.00000 %
		$n_{>USL}$	0	$p_{>USL}$	0.00000%
		$n_{<LSL}$	0	$p_{<LSL}$	0.00000%
		n_{eff}	100		
		n_{tot}	100		

Model distribution			Normal Distribution
Calculation method			$M1_{1,4}$ $\hat{\sigma} = s_{tot}$
Potential Capability index	=	C_m	23.69
Critical capability index	=	C_{mk}	21.37

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

APEX VDI/VDE 2647 V0.1

Machine Capability Study
Tool System

Plant	ATG Westhausen		Operator Name	Sünder	Date 02.02.2022

Ser.No.	756027_l	Characteristic			
Type	1BD-1B060A-1K2D-1VK2D	Char.Descr.	1K2D	Inspection Val.	42,40
Ord. No.	1BD53T2O-A	Ser.No.	202851	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}
202851	1K2D	42,15	42,19	42,38	42,18	42,32	42,45	42,54	42,55	42,64	42,15
202851	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}
202851	1K2D	42,61	42,32	42,68	42,83	42,42	42,65	42,33	42,88	42,15	43,01
202851	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}
202851	1K2D	41,98	42,77	42,13	42,52	42,92	42,18	42,53	42,43	42,68	42,47
202851	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}
202851	1K2D	42,68	42,77	42,49	42,75	42,68	42,48	43,01	42,50	42,28	42,18
202851	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_{41}	x_{42}	x_{43}	x_{44}	x_{45}	x_{46}	x_{47}	x_{48}	x_{49}	x_{50}
202851	1K2D	42,36	42,84	42,37	42,99	42,51	42,40	42,50	42,74	42,65	42,39
202851	1K2D	181,00	181,00	181,00	180,00	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}
202851	1K2D	42,91	41,94	43,11	42,42	42,79	42,91	42,29	42,25	42,69	42,27
202851	1K2D	181,00	181,00	180,00	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}
202851	1K2D	42,81	42,23	42,27	43,03	42,41	42,56	42,63	42,50	42,51	42,66
202851	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}
202851	1K2D	42,48	42,56	42,50	42,07	42,90	42,29	42,61	42,26	42,36	42,41
202851	1K2D	181,00	181,00	181,00	181,00	181,00	181,00	181,00	181,00	181,00	181,00

Machine Capability Study
Tool System

Plant	ATG Westhausen		Operator Name	Sünder	Date 02.02.2022

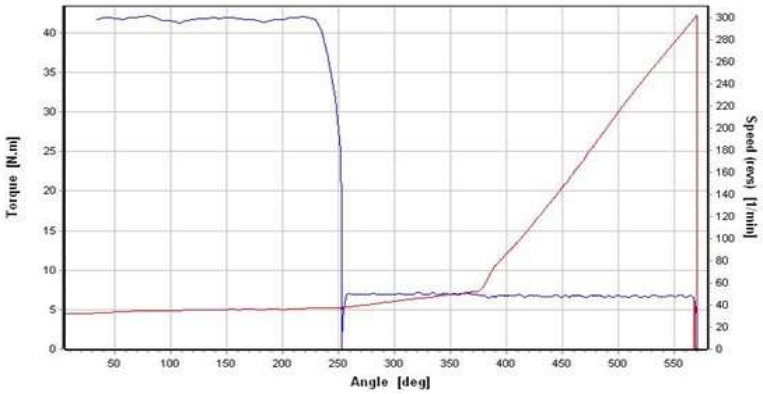
Ser.No.	756027_l	Characteristic			
Type	1BD-1B060A-1K2D-1VK2D	Char.Descr.	1K2D	Inspection Val.	42,40
Ord. No.	1BD53T2O-A	Ser.No.	202851	LSL	39,43
				USL	45,37
Remark	TQ 80% Angle 180°+/-10°* TQ-Cal.: 60.0 Nm; Cur-Cal.: 3.8391 Nm/A; Speed: 300/50 rpm;				

Char.No	Char.Descr.	x_{81}	x_{82}	x_{83}	x_{84}	x_{85}	x_{86}	x_{87}	x_{88}	x_{89}	x_{90}
202851	1K2D	42,27	42,75	42,36	42,19	43,28	42,54	42,68	43,19	42,52	42,96
202851	1K2D	181,00	181,00	181,00	181,00	181,00	181,00	181,00	181,00	181,00	181,00

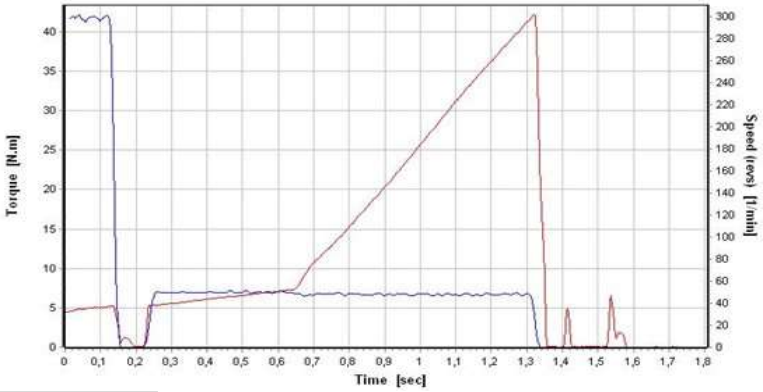
Char.No	Char.Descr.	x_{91}	x_{92}	x_{93}	x_{94}	x_{95}	x_{96}	x_{97}	x_{98}	x_{99}	x_{100}
202851	1K2D	42,36	42,87	42,81	42,74	42,41	42,54	42,77	42,94	42,03	42,76
202851	1K2D	181,00	181,00	181,00	181,00	181,00	181,00	181,00	181,00	181,00	181,00

Torque graphs

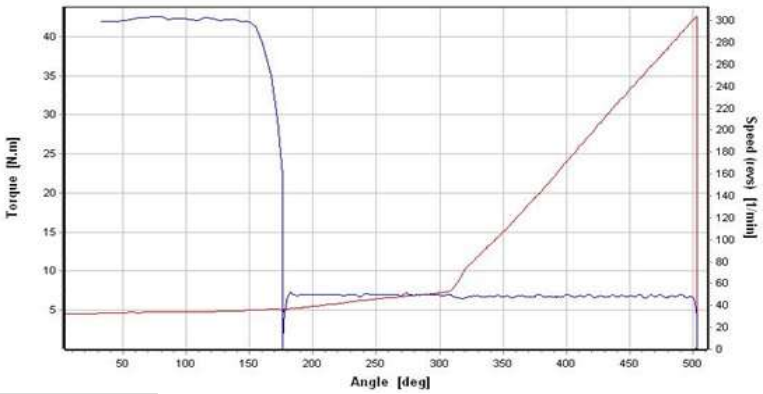
Model:	**1BD-1B060A-1K2D-1VK2D**	Serial no:	**756027**
Target torque:	**42,40 Nm**	80 % of max. torque	
Angle degree:	**180°**	Tool without angle correction	



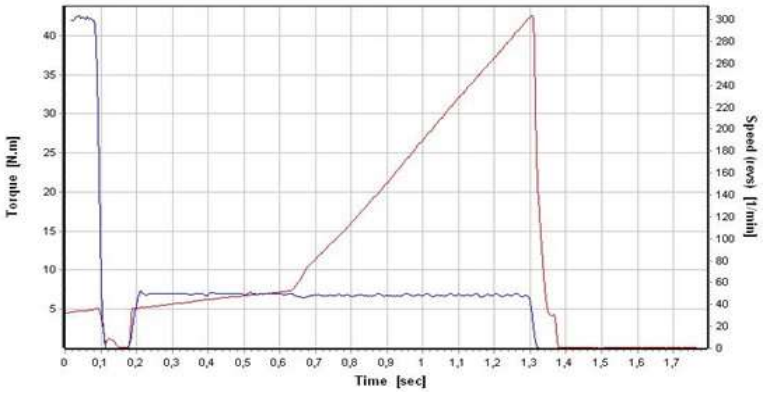
Value no. 1
Graph
Torque / Angle / Speed



Value no. 1
Graph
Torque / Time / Speed



Value no. 100
Graph
Torque / Angle / Speed



Value no. 100
Graph
Torque / Time / Speed