Homologation

Fixtured Spindle

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

Serial no.: 756028

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Homologation: 1BD-1B060A-1K2D-1VK2D SN: 756028

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Date: 08.12.2022

Test sheet no. 2

Machine Capability Study 30 %

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

Manufacturer: Apex Tool Group Serial no: **756028**

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

Hard joint (H)	118,11	Nm / Revolution	Angle degree	30°
Soft joint (L)	9,77	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	19,69	19,53 Nm
	Standard deviation	0,11	0,13 Nm
	Torque scatter (99,73%)	0,68	0,78 Nm
	C_m	4,02	3,51
	C_{mk}	3,80	3,30

b) Min. C_m hard/soft (lowest value) 3,51
Min. C_{mk} hard/soft (lowest value) 3,30

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

Note:

Machine Capability Study
Control System

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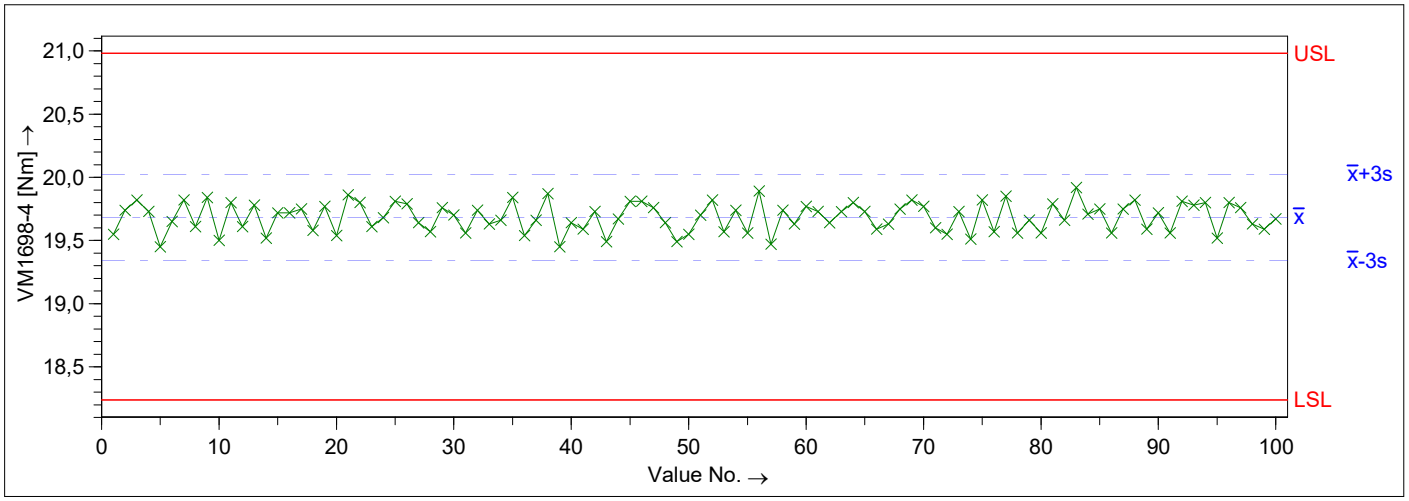
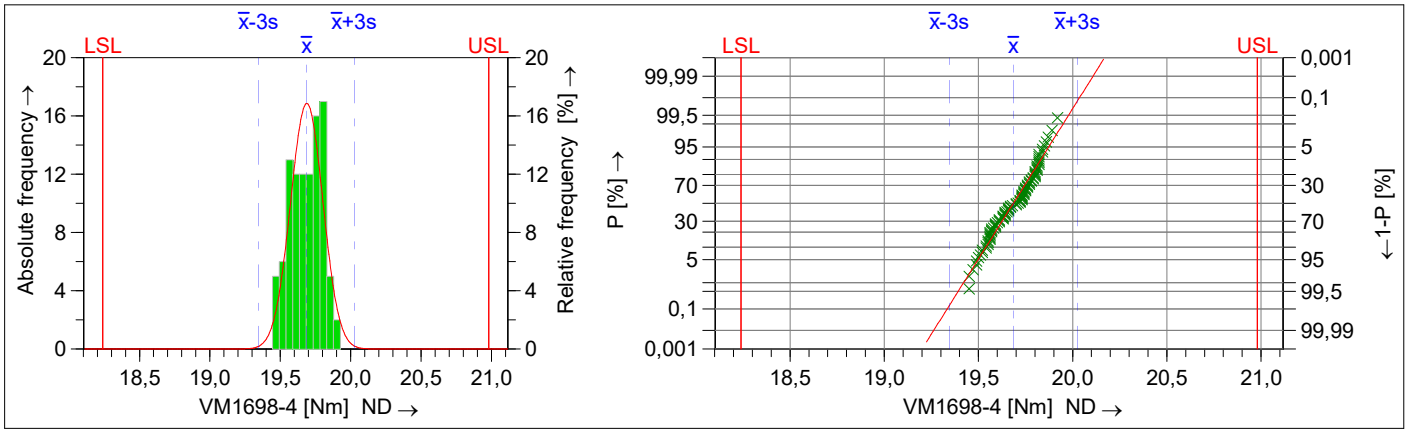
Plant	ATG Westhausen	Operator Name	Sünder
Date	08.02.2022		

Ord. No.	1BD53T2O-A	Part type	1BD-1B060A-1K1D-1VK2D	Contr.item	yes
Serial No.	756028_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 08.02.2022 08:51:08 to 08.02.2022 09:04:56

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			x̄	19.6853
LSL	18.24	x_{min}	19.45	x̄-3s	19.3445
USL	20.98	x_{max}	19.92	x̄+3s	20.0261
T	2.74	R	0.47	6s	0.6816
		$n_{<T>}$	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	4.02
Critical capability index	=	C_{mk}	3.80

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

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Machine Capability Study
Control System

Plant	ATG Westhausen		Operator Name	Sünder	Date 08.02.2022

Ser.No.	756028_d	Characteristic			
Type	1BD-1B060A-1K1D-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	19,55	19,74	19,82	19,73	19,45	19,65	19,82	19,61	19,84	19,50
1024210	VM1698-4	30,25	30,50	30,75	30,50	30,00	30,50	30,75	30,50	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	19,80	19,61	19,78	19,52	19,72	19,72	19,75	19,58	19,77	19,54
1024210	VM1698-4	30,75	30,25	31,00	30,00	30,50	30,25	30,75	30,50	30,75	30,25

Char.No.	Char.Descr.	x_{21}	x_{22}	x_{23}	x_{24}	x_{25}	x_{26}	x_{27}	x_{28}	x_{29}	x_{30}
1024210	VM1698-4	19,86	19,80	19,61	19,68	19,81	19,79	19,64	19,57	19,76	19,70
1024210	VM1698-4	30,75	30,75	30,25	30,00	30,75	30,50	30,50	30,25	30,75	30,25

Char.No.	Char.Descr.	x_{31}	x_{32}	x_{33}	x_{34}	x_{35}	x_{36}	x_{37}	x_{38}	x_{39}	x_{40}
1024210	VM1698-4	19,56	19,74	19,63	19,66	19,84	19,54	19,66	19,87	19,45	19,64
1024210	VM1698-4	30,25	30,25	30,25	30,25	30,75	30,25	30,25	30,25	30,00	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	19,59	19,73	19,49	19,67	19,81	19,81	19,76	19,64	19,49	19,55
1024210	VM1698-4	30,75	30,75	30,25	29,00	30,50	30,50	30,50	30,00	30,25	30,25

Char.No.	Char.Descr.	x_{51}	x_{52}	x_{53}	x_{54}	x_{55}	x_{56}	x_{57}	x_{58}	x_{59}	x_{60}
1024210	VM1698-4	19,70	19,82	19,57	19,74	19,56	19,89	19,47	19,74	19,63	19,77
1024210	VM1698-4	30,25	30,50	30,25	30,50	30,00	31,00	30,00	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	19,73	19,64	19,73	19,80	19,73	19,59	19,63	19,75	19,82	19,77
1024210	VM1698-4	30,25	30,50	30,75	30,50	30,50	30,25	30,50	30,50	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	19,60	19,55	19,73	19,51	19,82	19,57	19,85	19,56	19,66	19,56
1024210	VM1698-4	30,00	30,25	30,50	30,00	30,50	30,00	30,25	30,25	30,25	29,75

Machine Capability Study
Control System

Plant	ATG Westhausen		Operator Name	Sünder	Date 08.02.2022

Ser.No.	756028_d	Characteristic			
Type	1BD-1B060A-1K1D-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	19,79	19,66	19,92	19,71	19,75	19,56	19,75	19,82	19,59	19,72
1024210	VM1698-4	30,50	29,75	31,00	30,25	30,75	30,50	30,50	30,25	30,00	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	19,56	19,81	19,78	19,80	19,52	19,80	19,76	19,63	19,59	19,67
1024210	VM1698-4	30,00	29,25	30,75	30,50	30,25	30,50	30,25	30,25	29,75	30,25

Machine Capability Study
Tool System

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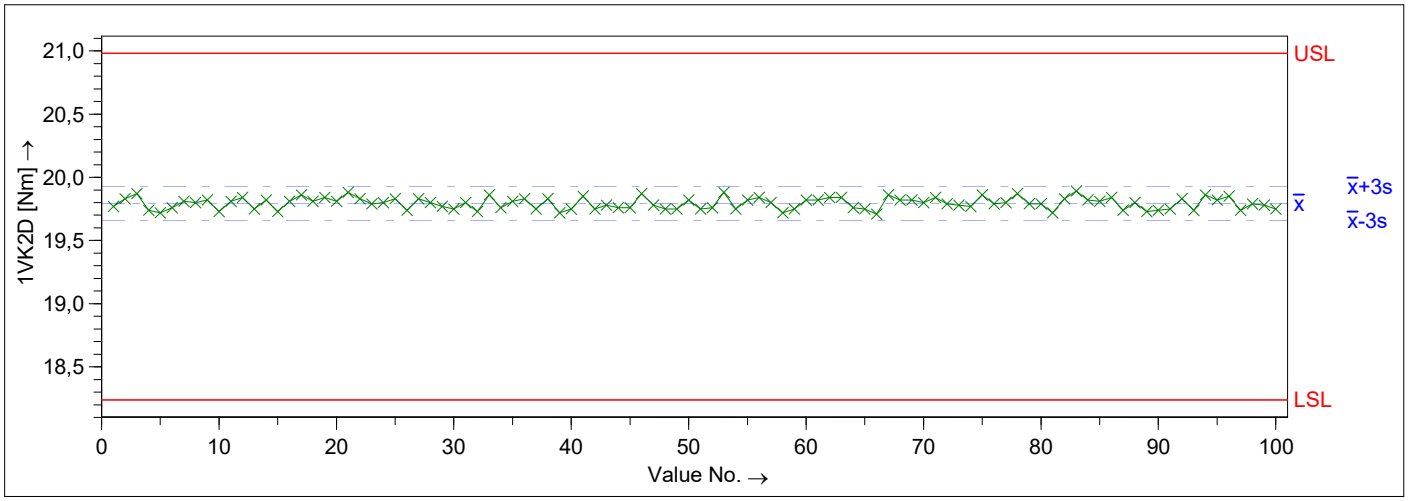
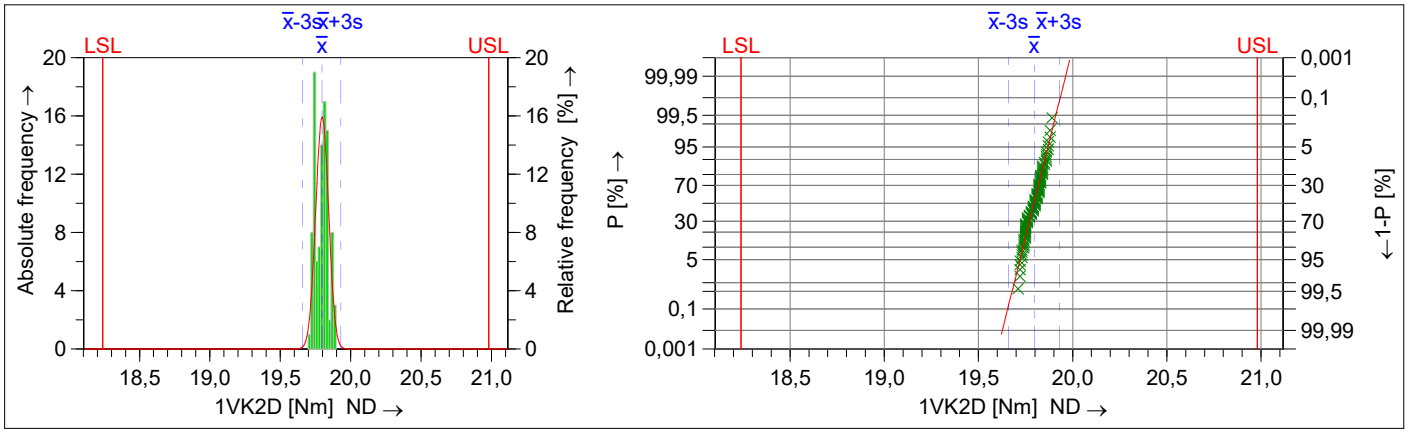
Plant	ATG Westhausen	Operator Name	Sünder
Date	08.02.2022		

Ord. No.	1BD53T2O-A	Part type	1BD-1B060A-1K1D-1VK2D	Contr.item	yes
Serial No.	756028_d	Char.Descr.	1VK2D	Inspection Val. 19,61 1,37	USL 20,98
		Serial No.	200693_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 08.02.2022 08:51:08 to 08.02.2022 09:04:56

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			$\bar{x}$	19.7948
LSL	18.24	x_{min}	19.71	$\bar{x}$-3s	19.6597
USL	20.98	x_{max}	19.89	$\bar{x}$+3s	19.9299
T	2.74	R	0.18	6s	0.2703
		$n_{<T>}$	100	$p_{<T>}$	100.00000 %
		$n_{>USL}$	0	$p_{>USL}$	0.00000%
		$n_{<LSL}$	0	$p_{<LSL}$	0.00000%
		n_{eff}	100		
		n_{tot}	100		

Model distribution			Normal Distribution
Calculation method			M1 1.4 $\hat{\sigma} = s_{tot}$
Potential Capability index	=	C_m	10.14
Critical capability index	=	C_{mk}	8.77

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

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Machine Capability Study
Tool System

Plant	ATG Westhausen		Operator Name	Sünder	Date 08.02.2022

Ser.No.	756028_d	Characteristic			
Type	1BD-1B060A-1K1D-1VK2D	Char.Descr.	1VK2D	Inspection Val.	19,61
Ord. No.	1BD53T2O-A	Ser.No.	200693_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}
200693_	1VK2D	19,77	19,83	19,87	19,74	19,72	19,76	19,81	19,80	19,82	19,73
200693_	1VK2D	31,00	30,00	30,00	30,00	30,00	30,00	31,00	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}
200693_	1VK2D	19,81	19,84	19,75	19,82	19,73	19,81	19,86	19,81	19,84	19,81
200693_	1VK2D	30,00	30,00	31,00	30,00	30,00	30,00	30,00	31,00	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}
200693_	1VK2D	19,88	19,83	19,79	19,80	19,83	19,74	19,83	19,80	19,77	19,75
200693_	1VK2D	31,00	31,00	31,00	30,00	30,00	30,00	30,00	31,00	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}
200693_	1VK2D	19,80	19,73	19,86	19,76	19,81	19,83	19,75	19,83	19,72	19,75
200693_	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_{41}	x_{42}	x_{43}	x_{44}	x_{45}	x_{46}	x_{47}	x_{48}	x_{49}	x_{50}
200693_	1VK2D	19,85	19,75	19,78	19,76	19,76	19,87	19,78	19,75	19,75	19,82
200693_	1VK2D	31,00	30,00	30,00	30,00	31,00	30,00	30,00	30,00	30,00	31,00

Char.No.	Char.Descr.	x_{51}	x_{52}	x_{53}	x_{54}	x_{55}	x_{56}	x_{57}	x_{58}	x_{59}	x_{60}
200693_	1VK2D	19,75	19,76	19,88	19,75	19,82	19,84	19,80	19,72	19,75	19,82
200693_	1VK2D	30,00	30,00	31,00	30,00	30,00	30,00	30,00	30,00	30,00	30,00

Char.No.	Char.Descr.	x_{61}	x_{62}	x_{63}	x_{64}	x_{65}	x_{66}	x_{67}	x_{68}	x_{69}	x_{70}
200693_	1VK2D	19,82	19,84	19,84	19,76	19,75	19,71	19,86	19,82	19,82	19,80
200693_	1VK2D	30,00	31,00	31,00	30,00	30,00	31,00	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}
200693_	1VK2D	19,84	19,79	19,78	19,77	19,86	19,79	19,80	19,87	19,79	19,79
200693_	1VK2D	30,00	31,00	30,00	30,00	30,00	31,00	30,00	30,00	31,00	30,00

Machine Capability Study
Tool System

Plant	ATG Westhausen		Operator Name	Sünder	Date 08.02.2022

Ser.No.	756028_d	Characteristic			
Type	1BD-1B060A-1K1D-1VK2D	Char.Descr.	1VK2D	Inspection Val.	19,61
Ord. No.	1BD53T2O-A	Ser.No.	200693_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}
200693_	1VK2D	19,72	19,83	19,89	19,82	19,81	19,84	19,74	19,80	19,73	19,74
200693_	1VK2D	30,00	30,00	30,00	30,00	31,00	31,00	30,00	30,00	31,00	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}
200693_	1VK2D	19,75	19,83	19,74	19,86	19,82	19,85	19,74	19,79	19,78	19,75
200693_	1VK2D	30,00	30,00	31,00	30,00	30,00	30,00	30,00	30,00	30,00	30,00

Machine Capability Study
Tool System

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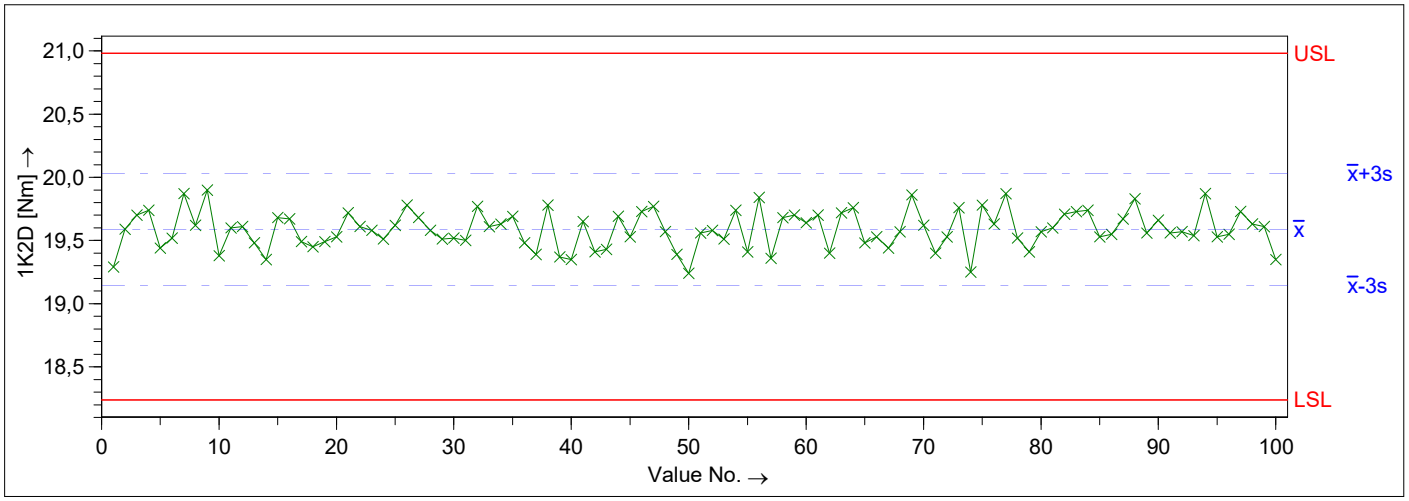
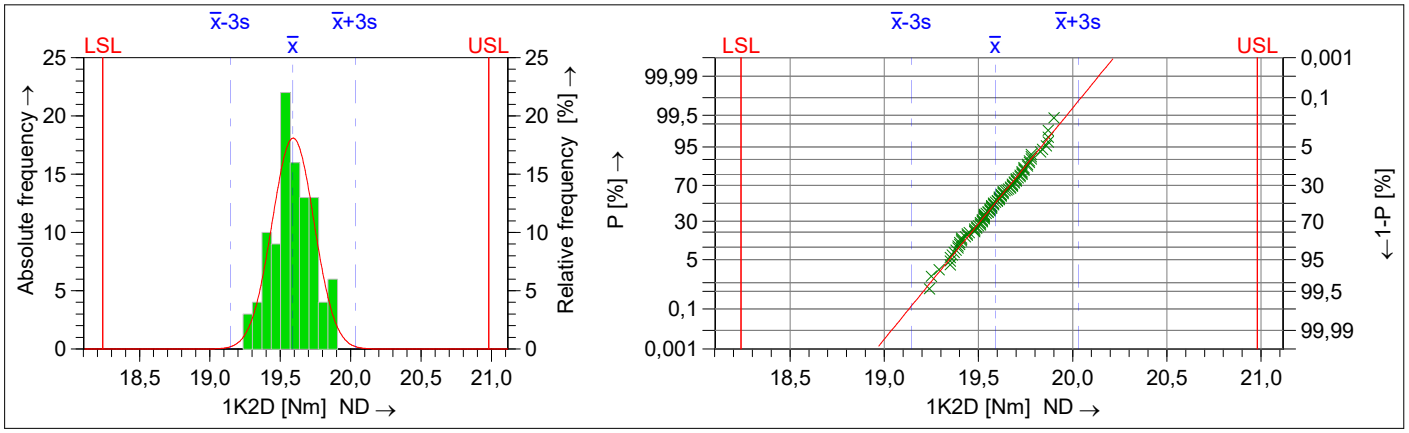
Plant	ATG Westhausen	Operator Name	Sünder
Date	08.02.2022		

Ord. No.	1BD53T2O-A	Part type	1BD-1B060A-1K1D-1VK2D	Contr.item	yes
Serial No.	756028_d	Char.Descr.	1K2D	Inspection Val. 19,61 1,37	USL 20,98
		Serial No.	202852	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 08.02.2022 08:51:08 to 08.02.2022 09:04:56

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			$\bar{x}$	19.5883
LSL	18.24	x_{min}	19.24	$\bar{x}$-3s	19.1453
USL	20.98	x_{max}	19.90	$\bar{x}$+3s	20.0313
T	2.74	R	0.66	6s	0.8861
		$n_{<T>}$	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	3.09
Critical capability index	=	C_{mk}	3.04

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 08.02.2022

Ser.No.	756028_d	Characteristic			
Type	1BD-1B060A-1K1D-1VK2D	Char.Descr.	1K2D	Inspection Val.	19,61
Ord. No.	1BD53T2O-A	Ser.No.	202852	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}
202852	1K2D	19,29	19,59	19,70	19,74	19,44	19,52	19,87	19,62	19,90	19,38
202852	1K2D	31,00	30,00	30,00	30,00	30,00	30,00	31,00	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}
202852	1K2D	19,60	19,61	19,48	19,35	19,68	19,67	19,49	19,45	19,49	19,53
202852	1K2D	30,00	30,00	31,00	30,00	30,00	30,00	30,00	31,00	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}
202852	1K2D	19,72	19,61	19,58	19,51	19,62	19,78	19,68	19,58	19,51	19,52
202852	1K2D	31,00	31,00	31,00	30,00	30,00	30,00	30,00	31,00	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}
202852	1K2D	19,50	19,77	19,61	19,63	19,69	19,48	19,39	19,78	19,37	19,35
202852	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_{41}	x_{42}	x_{43}	x_{44}	x_{45}	x_{46}	x_{47}	x_{48}	x_{49}	x_{50}
202852	1K2D	19,65	19,41	19,43	19,69	19,53	19,73	19,77	19,57	19,39	19,24
202852	1K2D	31,00	30,00	30,00	30,00	31,00	30,00	30,00	30,00	30,00	31,00

Char.No.	Char.Descr.	x_{51}	x_{52}	x_{53}	x_{54}	x_{55}	x_{56}	x_{57}	x_{58}	x_{59}	x_{60}
202852	1K2D	19,56	19,58	19,51	19,74	19,41	19,84	19,36	19,68	19,70	19,64
202852	1K2D	30,00	30,00	31,00	30,00	30,00	30,00	30,00	30,00	30,00	30,00

Char.No.	Char.Descr.	x_{61}	x_{62}	x_{63}	x_{64}	x_{65}	x_{66}	x_{67}	x_{68}	x_{69}	x_{70}
202852	1K2D	19,70	19,40	19,72	19,76	19,48	19,53	19,44	19,57	19,86	19,62
202852	1K2D	30,00	31,00	31,00	30,00	30,00	31,00	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}
202852	1K2D	19,40	19,53	19,76	19,25	19,78	19,63	19,87	19,52	19,41	19,57
202852	1K2D	30,00	31,00	30,00	30,00	30,00	31,00	30,00	30,00	31,00	30,00

Machine Capability Study
Tool System

Plant	ATG Westhausen		Operator Name	Sünder	Date 08.02.2022

Ser.No.	756028_d	Characteristic			
Type	1BD-1B060A-1K1D-1VK2D	Char.Descr.	1K2D	Inspection Val.	19,61
Ord. No.	1BD53T2O-A	Ser.No.	202852	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}
202852	1K2D	19,60	19,71	19,73	19,74	19,53	19,55	19,67	19,83	19,56	19,66
202852	1K2D	30,00	30,00	30,00	30,00	31,00	31,00	30,00	30,00	31,00	30,00

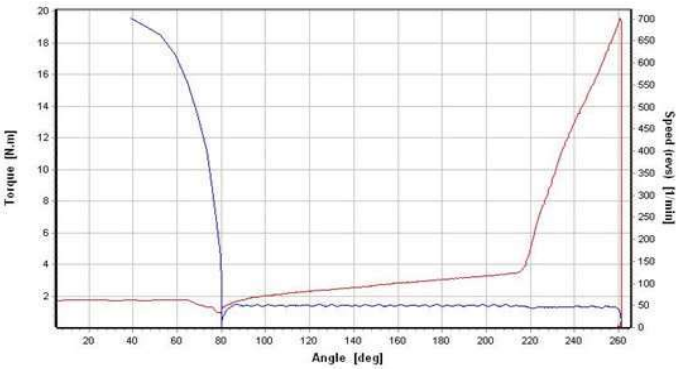
Char.No.	Char.Descr.	x_{91}	x_{92}	x_{93}	x_{94}	x_{95}	x_{96}	x_{97}	x_{98}	x_{99}	x_{100}
202852	1K2D	19,56	19,57	19,54	19,87	19,53	19,55	19,73	19,63	19,61	19,35
202852	1K2D	30,00	30,00	31,00	30,00	30,00	30,00	30,00	30,00	30,00	30,00

Torque graphs

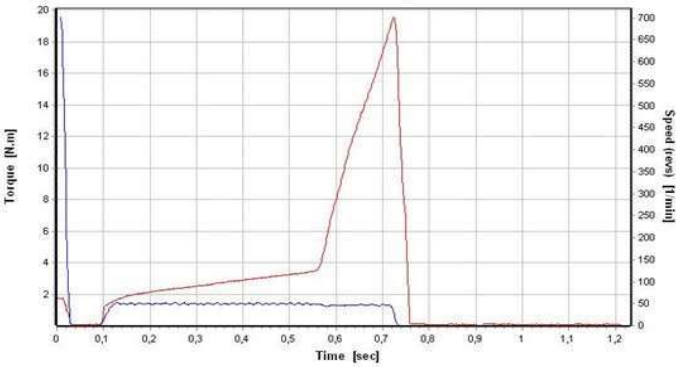
Machine Capability Study 30 %

Model: **1BD-1B060A-1K2D-1VK2D**
Serial no: **756028**

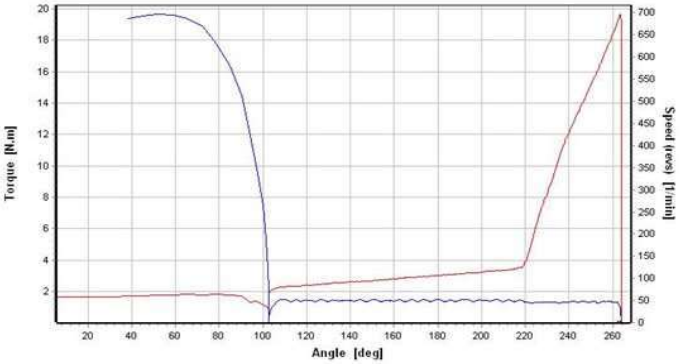
Angle degree: **30°**
Test torque: **19,6 Nm**



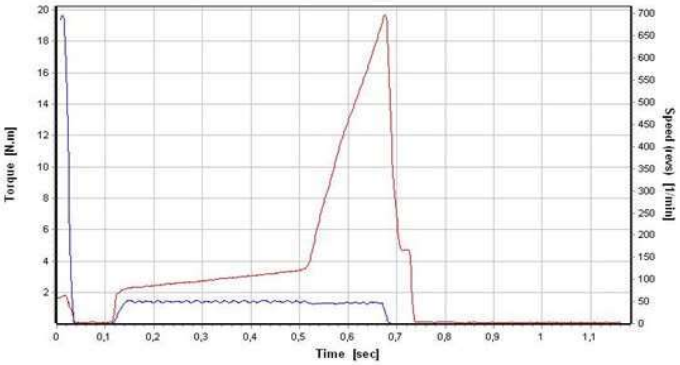
Value no. 1
Graph
Torque / Angle / Speed



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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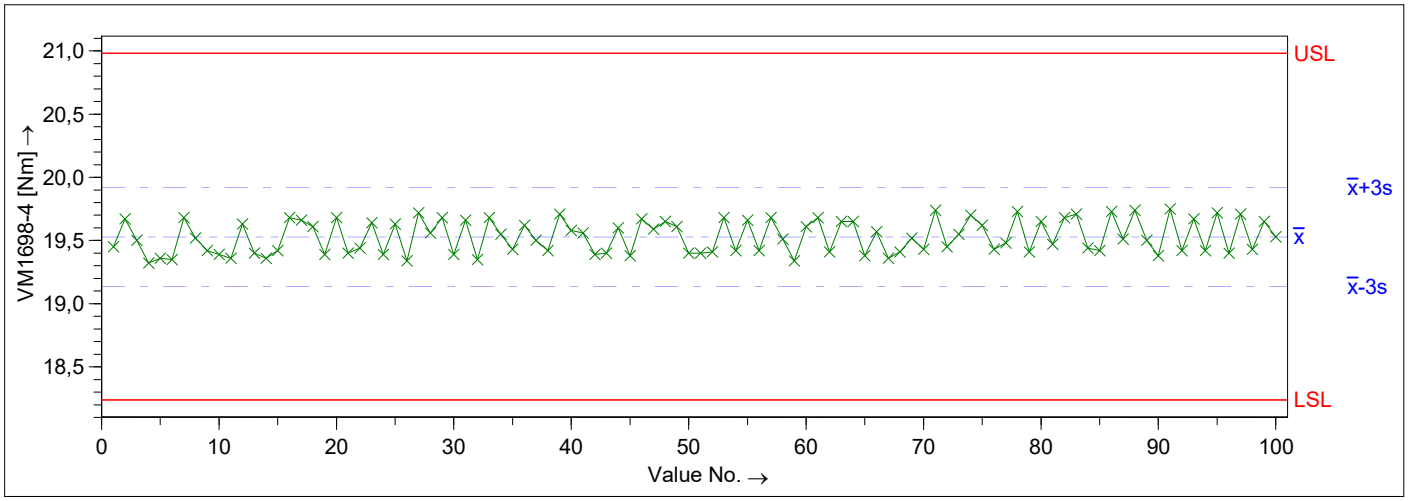
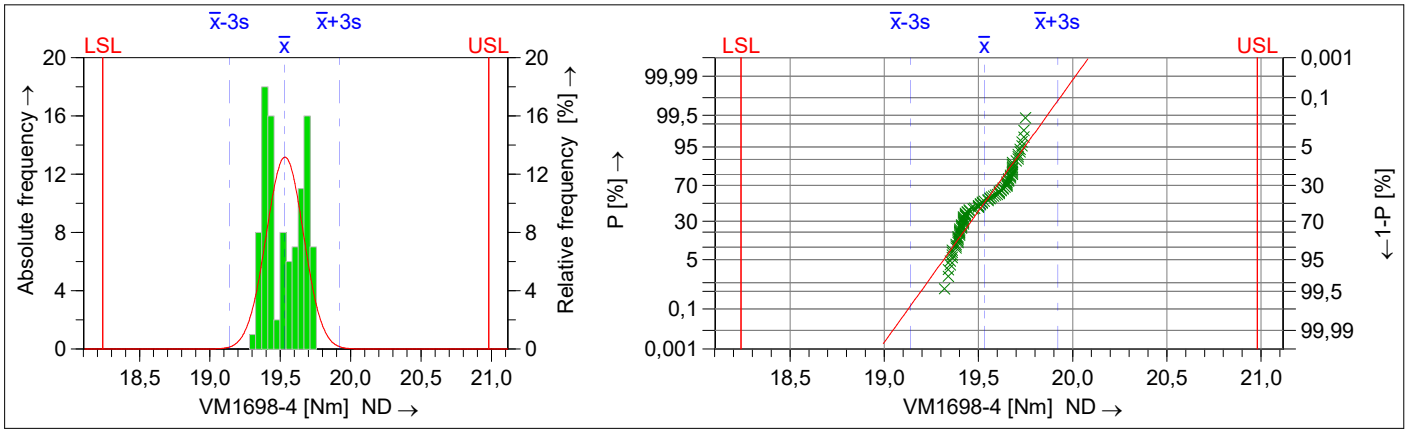
Plant	ATG Westhausen	Operator Name	Sünder
Date	08.02.2022		

Ord. No.	1BD53T2O-A	Part type	1BD-1B060A-1K1D-1VK2D	Contr.item	yes
Serial No.	756028_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 08.02.2022 09:19:55 to 08.02.2022 09:37:53

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





Drawing Values		Collected Values		Statistics	
T_m	19.61			x̄	19.5302
LSL	18.24	x_{min}	19.32	x̄-3s	19.1396
USL	20.98	x_{max}	19.75	x̄+3s	19.9208
T	2.74	R	0.43	6s	0.7812
		$n_{<T>}$	100	$p_{<T>}$	100.00000 %
		$n_{>USL}$	0	$p_{>USL}$	0.00000%
		$n_{<LSL}$	0	$p_{<LSL}$	0.00000%
		n_{eff}	100		
		n_{tot}	100		

Model distribution			Normal Distribution
Calculation method			M1 1.4 $\hat{\sigma} = s_{tot}$
Potential Capability index	=	C_m	3.51
Critical capability index	=	C_{mk}	3.30

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

APEX VDI/VDE 2647 V0.1

Apex Tool Group GmbH \\htwe0006\AppData\QW\QWE\MessWert\2022\756028_cM.DFD

Machine Capability Study
Control System

Plant	ATG Westhausen		Operator Name	Sünder	Date 08.02.2022

Ser.No.	756028_c	Characteristic			
Type	1BD-1B060A-1K1D-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	19,45	19,67	19,50	19,32	19,36	19,35	19,68	19,52	19,42	19,39
1024210	VM1698-4	361,50	376,25	358,75	355,50	351,75	345,50	364,75	361,25	353,00	352,75

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	19,36	19,63	19,40	19,36	19,42	19,68	19,66	19,61	19,39	19,68
1024210	VM1698-4	347,75	354,00	359,25	350,00	368,75	357,75	367,50	365,75	346,25	359,25

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	19,40	19,44	19,64	19,39	19,63	19,34	19,72	19,56	19,68	19,39
1024210	VM1698-4	363,50	357,00	366,50	356,50	361,25	346,00	363,25	364,50	367,75	353,75

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	19,66	19,35	19,68	19,55	19,43	19,62	19,50	19,42	19,71	19,58
1024210	VM1698-4	354,50	348,00	357,00	364,25	356,75	365,75	363,25	362,75	363,75	364,25

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	19,56	19,39	19,40	19,60	19,38	19,67	19,59	19,65	19,61	19,40
1024210	VM1698-4	366,00	360,00	362,50	381,00	360,75	363,50	362,50	366,50	368,75	354,50

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	19,40	19,41	19,68	19,42	19,66	19,42	19,68	19,51	19,34	19,61
1024210	VM1698-4	351,75	353,50	360,75	355,50	361,50	356,50	358,50	355,00	361,75	359,25

Char.No.	Char.Descr.	x_{61}	x_{62}	x_{63}	x_{64}	x_{65}	x_{66}	x_{67}	x_{68}	x_{69}	x_{70}
1024210	VM1698-4	19,68	19,41	19,65	19,65	19,38	19,57	19,36	19,41	19,52	19,43
1024210	VM1698-4	363,00	365,00	370,75	373,50	377,00	372,00	351,75	338,75	349,50	346,75

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	19,74	19,45	19,55	19,70	19,62	19,43	19,48	19,73	19,41	19,65
1024210	VM1698-4	357,50	356,00	359,00	366,25	371,75	358,75	351,50	365,25	352,75	360,75

Machine Capability Study
Control System

Plant	ATG Westhausen		Operator Name	Sünder	Date 08.02.2022

Ser.No.	756028_c	Characteristic			
Type	1BD-1B060A-1K1D-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	19,47	19,68	19,71	19,44	19,42	19,73	19,51	19,74	19,50	19,38
1024210	VM1698-4	352,00	362,25	363,75	357,25	362,75	369,25	354,25	366,00	362,25	350,00

Char.No.	Char.Descr.	x_{91}	x_{92}	x_{93}	x_{94}	x_{95}	x_{96}	x_{97}	x_{98}	x_{99}	x_{100}
1024210	VM1698-4	19,75	19,42	19,67	19,42	19,72	19,40	19,71	19,43	19,65	19,53
1024210	VM1698-4	362,50	353,25	362,75	350,25	365,00	351,75	361,75	348,50	365,75	360,25

Machine Capability Study
Tool System

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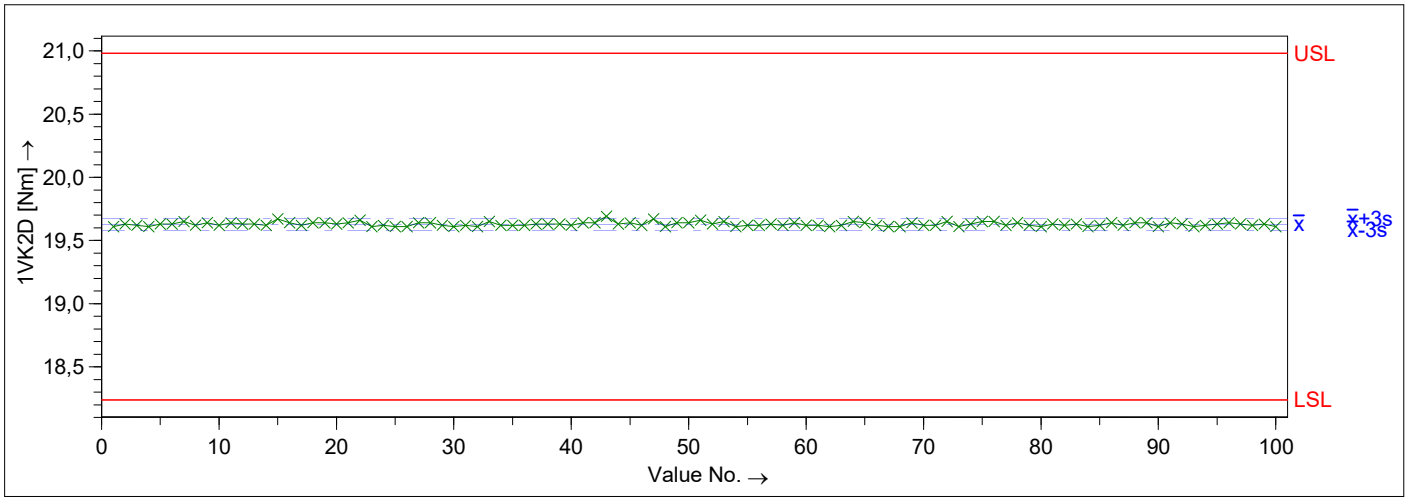
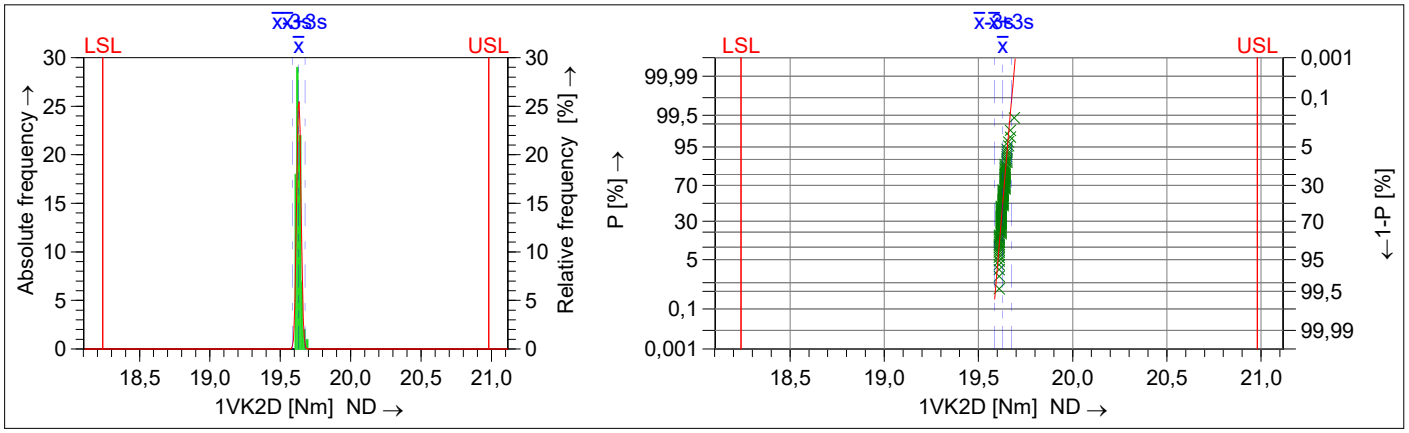
Plant ATG Westhausen		Operator Name Sünder	Date 08.02.2022

Ord. No. 1BD53T2O-A	Part type 1BD-1B060A-1K1D-1VK2D				Contr.item yes
Serial No. 756028_c	Char.Descr. 1VK2D	Inspection Val.	19,61	1,37	USL 20,98
	Serial No. 200693_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 08.02.2022 09:19:55 to 08.02.2022 09:37:53

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			$\bar{x}$	19.6291
LSL	18.24	x_{min}	19.61	$\bar{x}$-3s	19.5828
USL	20.98	x_{max}	19.69	$\bar{x}$+3s	19.6754
T	2.74	R	0.08	6s	0.0927
		$n_{<T>}$	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	29.57
Critical capability index	=	C_{mk}	29.15

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 08.02.2022

Ser.No.	756028_c	Characteristic			
Type	1BD-1B060A-1K1D-1VK2D	Char.Descr.	1VK2D	Inspection Val.	19,61
Ord. No.	1BD53T2O-A	Ser.No.	200693_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}
200693_	1VK2D	19,61	19,63	19,62	19,61	19,63	19,63	19,65	19,62	19,64	19,62
200693_	1VK2D	364,00	375,00	360,00	363,00	357,00	353,00	363,00	361,00	358,00	357,00

Char.No.	Char.Descr.	x_{11}	x_{12}	x_{13}	x_{14}	x_{15}	x_{16}	x_{17}	x_{18}	x_{19}	x_{20}
200693_	1VK2D	19,64	19,63	19,63	19,62	19,67	19,64	19,62	19,64	19,64	19,63
200693_	1VK2D	354,00	353,00	363,00	354,00	372,00	355,00	365,00	365,00	353,00	358,00

Char.No.	Char.Descr.	x_{21}	x_{22}	x_{23}	x_{24}	x_{25}	x_{26}	x_{27}	x_{28}	x_{29}	x_{30}
200693_	1VK2D	19,64	19,66	19,61	19,62	19,61	19,61	19,64	19,64	19,62	19,61
200693_	1VK2D	368,00	361,00	364,00	361,00	360,00	353,00	361,00	365,00	365,00	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}
200693_	1VK2D	19,62	19,61	19,65	19,62	19,62	19,62	19,63	19,63	19,63	19,62
200693_	1VK2D	354,00	355,00	356,00	365,00	360,00	365,00	364,00	366,00	361,00	363,00

Char.No.	Char.Descr.	x_{41}	x_{42}	x_{43}	x_{44}	x_{45}	x_{46}	x_{47}	x_{48}	x_{49}	x_{50}
200693_	1VK2D	19,64	19,64	19,69	19,63	19,64	19,62	19,67	19,61	19,64	19,64
200693_	1VK2D	366,00	364,00	366,00	379,00	366,00	362,00	363,00	366,00	368,00	360,00

Char.No.	Char.Descr.	x_{51}	x_{52}	x_{53}	x_{54}	x_{55}	x_{56}	x_{57}	x_{58}	x_{59}	x_{60}
200693_	1VK2D	19,66	19,63	19,65	19,61	19,62	19,62	19,63	19,62	19,64	19,62
200693_	1VK2D	358,00	358,00	360,00	360,00	360,00	359,00	357,00	357,00	365,00	357,00

Char.No.	Char.Descr.	x_{61}	x_{62}	x_{63}	x_{64}	x_{65}	x_{66}	x_{67}	x_{68}	x_{69}	x_{70}
200693_	1VK2D	19,62	19,61	19,62	19,65	19,64	19,62	19,61	19,61	19,64	19,62
200693_	1VK2D	362,00	370,00	369,00	372,00	382,00	372,00	358,00	346,00	351,00	351,00

Char.No.	Char.Descr.	x_{71}	x_{72}	x_{73}	x_{74}	x_{75}	x_{76}	x_{77}	x_{78}	x_{79}	x_{80}
200693_	1VK2D	19,62	19,65	19,61	19,63	19,65	19,65	19,62	19,64	19,62	19,61
200693_	1VK2D	354,00	359,00	359,00	361,00	371,00	360,00	354,00	363,00	357,00	358,00

Machine Capability Study
Tool System

Plant	ATG Westhausen		Operator Name	Sünder	Date 08.02.2022

Ser.No.	756028_c	Characteristic			
Type	1BD-1B060A-1K1D-1VK2D	Char.Descr.	1VK2D	Inspection Val.	19,61
Ord. No.	1BD53T2O-A	Ser.No.	200693_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}
200693_	1VK2D	19,63	19,62	19,63	19,61	19,62	19,64	19,62	19,64	19,64	19,61
200693_	1VK2D	355,00	360,00	361,00	359,00	366,00	365,00	357,00	362,00	364,00	353,00

Char.No.	Char.Descr.	x_{91}	x_{92}	x_{93}	x_{94}	x_{95}	x_{96}	x_{97}	x_{98}	x_{99}	x_{100}
200693_	1VK2D	19,64	19,63	19,61	19,62	19,63	19,64	19,63	19,62	19,63	19,61
200693_	1VK2D	358,00	356,00	361,00	353,00	361,00	354,00	358,00	352,00	364,00	361,00

Machine Capability Study
Tool System

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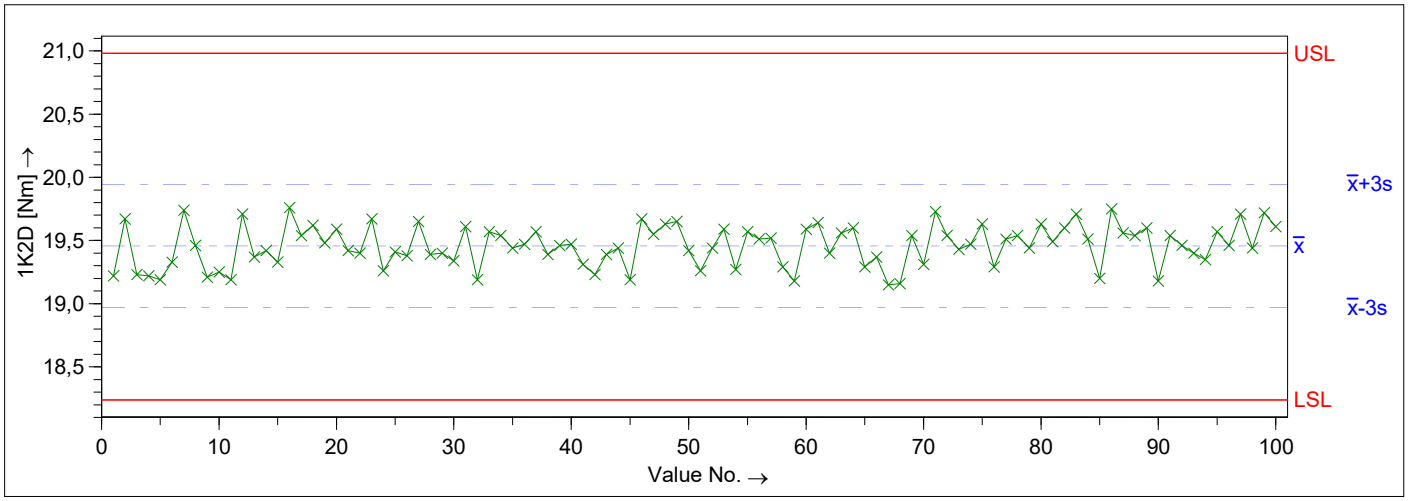
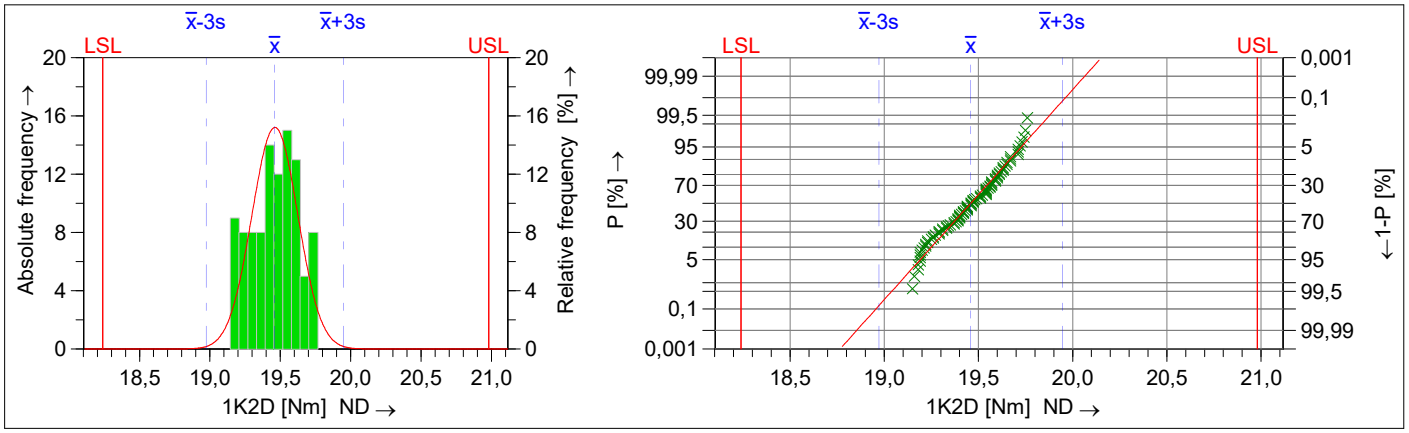
Plant	ATG Westhausen	Operator Name	Sünder
Date	08.02.2022		

Ord. No.	1BD53T2O-A	Part type	1BD-1B060A-1K1D-1VK2D	Contr.item	yes
Serial No.	756028_c	Char.Descr.	1K2D	Inspection Val. 19,61 1,37	USL 20,98
		Serial No.	202852	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 08.02.2022 09:19:55 to 08.02.2022 09:37:53

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			$\bar{x}$	19.4589
LSL	18.24	x_{min}	19.15	$\bar{x}$-3s	18.9711
USL	20.98	x_{max}	19.76	$\bar{x}$+3s	19.9467
T	2.74	R	0.61	6s	0.9757
		$n_{<T>}$	100	$p_{<T>}$	100.00000 %
		$n_{>USL}$	0	$p_{>USL}$	0.00000%
		$n_{<LSL}$	0	$p_{<LSL}$	0.00000%
		n_{eff}	100		
		n_{tot}	100		

Model distribution			Normal Distribution
Calculation method			$M1_{1.4}$ $\hat{\sigma} = s_{tot}$
Potential Capability index	=	C_m	2.81
Critical capability index	=	C_{mk}	2.50

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 08.02.2022

Ser.No.	756028_c	Characteristic			
Type	1BD-1B060A-1K1D-1VK2D	Char.Descr.	1K2D	Inspection Val.	19,61
Ord. No.	1BD53T2O-A	Ser.No.	202852	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}
202852	1K2D	19,22	19,67	19,23	19,22	19,19	19,33	19,74	19,46	19,21	19,25
202852	1K2D	364,00	375,00	360,00	363,00	357,00	353,00	363,00	361,00	358,00	357,00

Char.No.	Char.Descr.	x_{11}	x_{12}	x_{13}	x_{14}	x_{15}	x_{16}	x_{17}	x_{18}	x_{19}	x_{20}
202852	1K2D	19,19	19,71	19,37	19,42	19,33	19,76	19,54	19,62	19,48	19,59
202852	1K2D	354,00	353,00	363,00	354,00	372,00	355,00	365,00	365,00	353,00	358,00

Char.No.	Char.Descr.	x_{21}	x_{22}	x_{23}	x_{24}	x_{25}	x_{26}	x_{27}	x_{28}	x_{29}	x_{30}
202852	1K2D	19,42	19,40	19,67	19,26	19,41	19,38	19,65	19,39	19,40	19,34
202852	1K2D	368,00	361,00	364,00	361,00	360,00	353,00	361,00	365,00	365,00	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}
202852	1K2D	19,61	19,19	19,57	19,54	19,44	19,47	19,57	19,39	19,46	19,47
202852	1K2D	354,00	355,00	356,00	365,00	360,00	365,00	364,00	366,00	361,00	363,00

Char.No.	Char.Descr.	x_{41}	x_{42}	x_{43}	x_{44}	x_{45}	x_{46}	x_{47}	x_{48}	x_{49}	x_{50}
202852	1K2D	19,31	19,23	19,39	19,44	19,19	19,67	19,55	19,63	19,65	19,42
202852	1K2D	366,00	364,00	366,00	379,00	366,00	362,00	363,00	366,00	368,00	360,00

Char.No.	Char.Descr.	x_{51}	x_{52}	x_{53}	x_{54}	x_{55}	x_{56}	x_{57}	x_{58}	x_{59}	x_{60}
202852	1K2D	19,26	19,44	19,59	19,27	19,57	19,51	19,52	19,29	19,18	19,59
202852	1K2D	358,00	358,00	360,00	360,00	360,00	359,00	357,00	357,00	365,00	357,00

Char.No.	Char.Descr.	x_{61}	x_{62}	x_{63}	x_{64}	x_{65}	x_{66}	x_{67}	x_{68}	x_{69}	x_{70}
202852	1K2D	19,64	19,40	19,56	19,60	19,29	19,37	19,15	19,16	19,54	19,31
202852	1K2D	362,00	370,00	369,00	372,00	382,00	372,00	358,00	346,00	351,00	351,00

Char.No.	Char.Descr.	x_{71}	x_{72}	x_{73}	x_{74}	x_{75}	x_{76}	x_{77}	x_{78}	x_{79}	x_{80}
202852	1K2D	19,73	19,54	19,43	19,47	19,63	19,29	19,51	19,54	19,44	19,63
202852	1K2D	354,00	359,00	359,00	361,00	371,00	360,00	354,00	363,00	357,00	358,00

Machine Capability Study
Tool System

Plant	ATG Westhausen		Operator Name	Sünder	Date 08.02.2022

Ser.No.	756028_c	Characteristic			
Type	1BD-1B060A-1K1D-1VK2D	Char.Descr.	1K2D	Inspection Val.	19,61
Ord. No.	1BD53T2O-A	Ser.No.	202852	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}
202852	1K2D	19,49	19,60	19,71	19,51	19,20	19,75	19,56	19,54	19,60	19,18
202852	1K2D	355,00	360,00	361,00	359,00	366,00	365,00	357,00	362,00	364,00	353,00

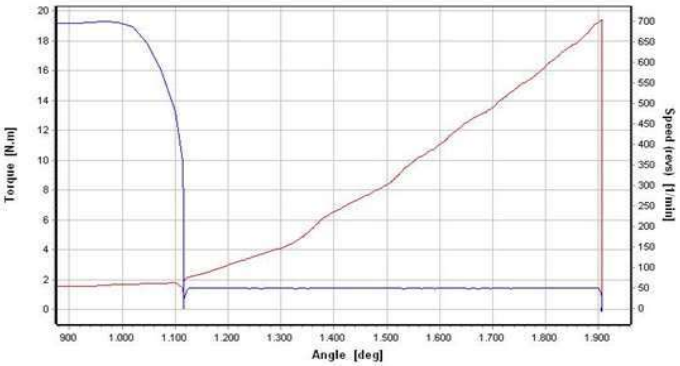
Char.No.	Char.Descr.	x_{91}	x_{92}	x_{93}	x_{94}	x_{95}	x_{96}	x_{97}	x_{98}	x_{99}	x_{100}
202852	1K2D	19,54	19,46	19,40	19,35	19,57	19,46	19,71	19,44	19,72	19,61
202852	1K2D	358,00	356,00	361,00	353,00	361,00	354,00	358,00	352,00	364,00	361,00

Torque graphs

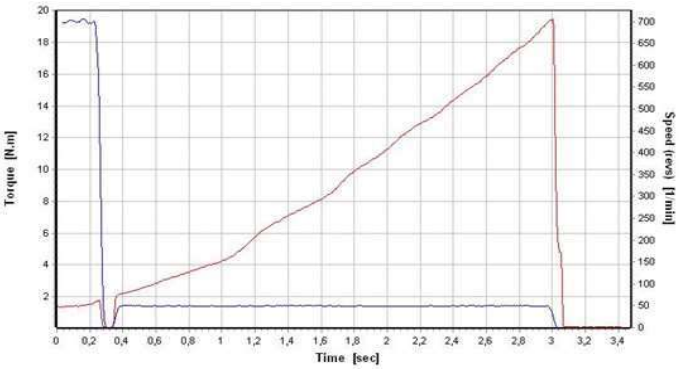
Machine Capability Study 30 %

Model: **1BD-1B060A-1K2D-1VK2D**
Serial no: **756028**

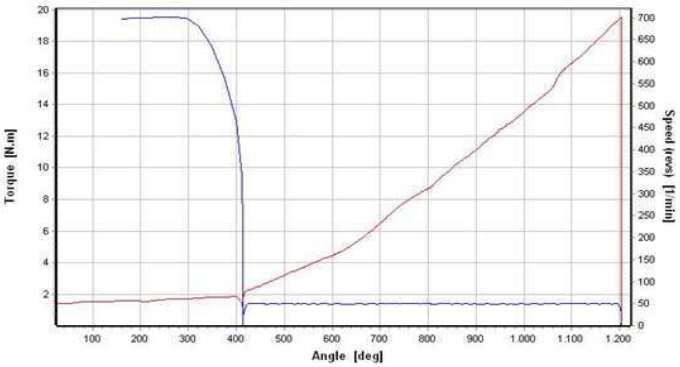
Angle degree: **360°**
Test torque: **19,6 Nm**



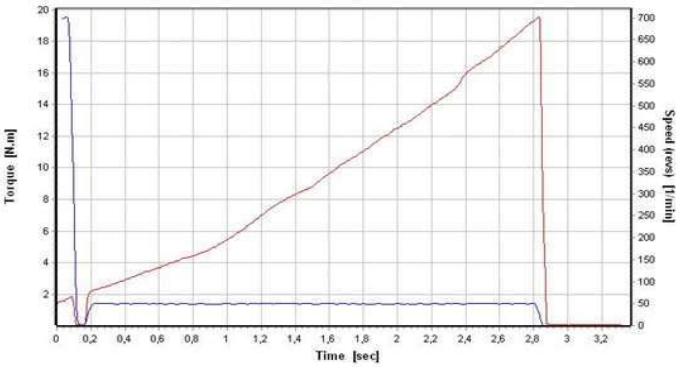
Value no. 1
Graph
Torque / Angle / Speed



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: **756028**

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

Hard joint (H)	260,85 Nm / Revolution	Angle degree	30°
Soft joint (L)	21,61 Nm / Revolution	Angle degree	360°

a)

	H	L
Tolerance down / up	40,42 46,50 Nm	40,42 - 46,50 Nm
Tolerance down / up	7	7 %
Average torque	43,48	43,22 Nm
Standard deviation	0,19	0,19 Nm
Torque scatter (99,73%)	1,13	1,16 Nm
C_m	5,36	5,24
C_{mk}	5,34	4,83

b)

Min. C_m hard/soft (lowest value)	5,24
Min. C_{mk} hard/soft (lowest value)	4,83

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

Note:

Machine Capability Study
Control System

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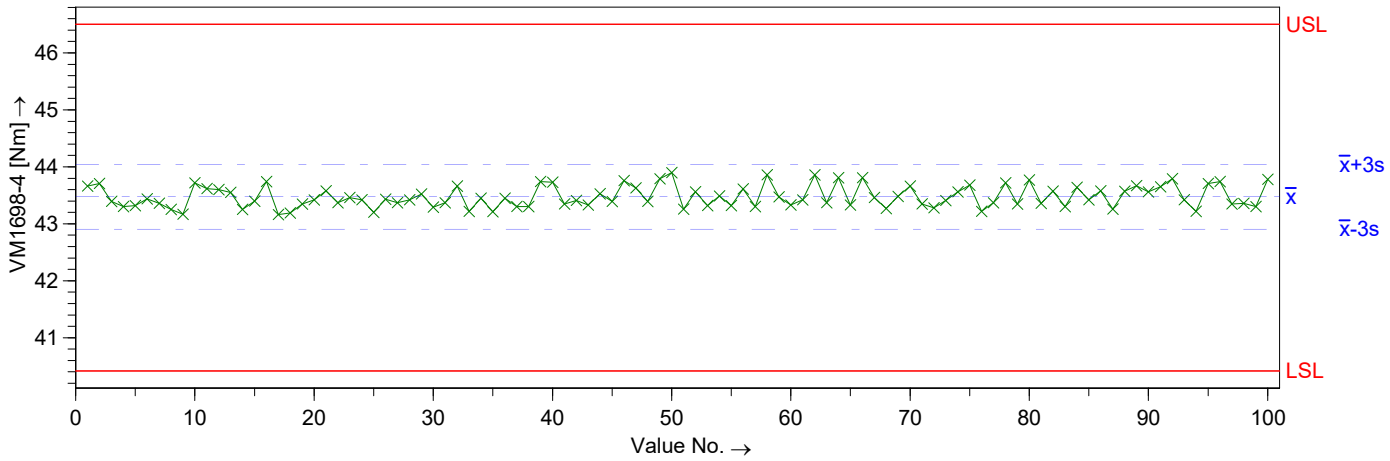
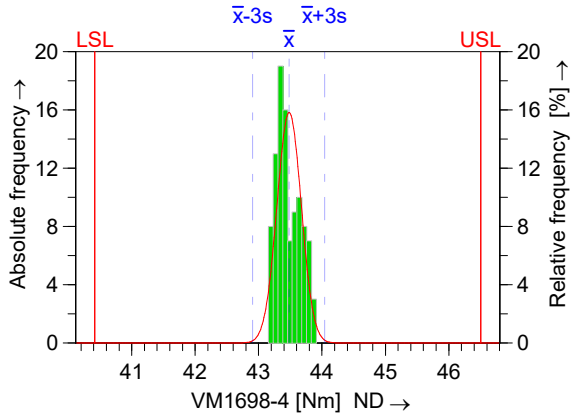
Plant	ATG Westhausen	Operator Name	Sünder
Date	08.02.2022		

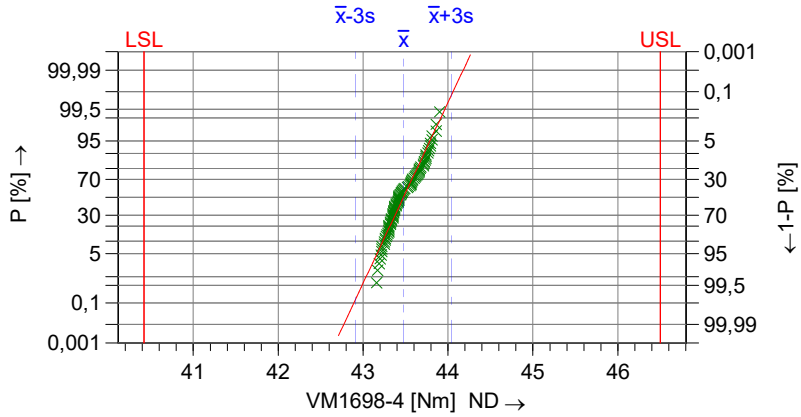
Ord. No.	1BD53T2O-A	Part type	1BD-1B060A-1K1D-1VK2D	Contr.item	yes
Serial No.	756028_h	Char.Descr.	VM1698-4	Inspection Val. 43,46 3,04	USL 46,50
		Serial No.	1024210	Unit Nm -3,04	LSL 40,42
Char.Type	variable			Tolerance value 7 %	Decimal Pl. 2
Cust.Name	Cleco	Reference System	VM1698-4	Test Electronic	MPRO400GCD-P
Contr.No.	Homologation	Reference Transducer	50 / 1024729	nges.	100

Evaluation from 08.02.2022 10:29:31 to 08.02.2022 10:44:48

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			x̄	43.4752
LSL	40.42	x_{min}	43.16	x̄-3s	42.9085
USL	46.50	x_{max}	43.90	x̄+3s	44.0419
T	6.08	R	0.74	6s	1.1334
		$n_{<T>}$	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	5.36
Critical capability index	=	C_{mk}	5.34

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 08.02.2022

Ser.No.	756028_h	Characteristic			
Type	1BD-1B060A-1K1D-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	43,66	43,71	43,39	43,30	43,32	43,44	43,36	43,25	43,17	43,72
1024210	VM1698-4	31,00	30,25	28,50	30,00	30,00	30,25	30,25	30,00	30,00	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}
1024210	VM1698-4	43,62	43,60	43,55	43,25	43,40	43,74	43,16	43,19	43,35	43,42
1024210	VM1698-4	30,75	30,75	30,50	30,00	30,50	30,75	30,00	30,00	30,25	30,50

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	43,58	43,37	43,46	43,42	43,20	43,43	43,37	43,42	43,52	43,29
1024210	VM1698-4	30,50	30,25	30,50	30,50	28,25	30,25	30,25	27,25	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	43,37	43,66	43,22	43,45	43,21	43,45	43,30	43,30	43,74	43,73
1024210	VM1698-4	30,25	30,75	30,00	30,50	28,50	30,50	30,25	30,50	30,75	31,00

Char.No.	Char.Descr.	x_{41}	x_{42}	x_{43}	x_{44}	x_{45}	x_{46}	x_{47}	x_{48}	x_{49}	x_{50}
1024210	VM1698-4	43,35	43,41	43,33	43,53	43,39	43,76	43,63	43,39	43,79	43,90
1024210	VM1698-4	30,25	30,25	30,25	30,50	30,00	31,00	30,50	30,25	31,00	31,25

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	43,26	43,56	43,32	43,49	43,32	43,61	43,30	43,86	43,47	43,33
1024210	VM1698-4	29,50	29,75	29,50	30,00	29,75	30,25	29,25	30,75	29,50	29,75

Char.No.	Char.Descr.	x_{61}	x_{62}	x_{63}	x_{64}	x_{65}	x_{66}	x_{67}	x_{68}	x_{69}	x_{70}
1024210	VM1698-4	43,42	43,86	43,37	43,81	43,33	43,81	43,46	43,27	43,48	43,66
1024210	VM1698-4	30,00	30,50	29,75	30,50	29,75	30,50	30,00	29,75	29,75	30,00

Char.No.	Char.Descr.	x_{71}	x_{72}	x_{73}	x_{74}	x_{75}	x_{76}	x_{77}	x_{78}	x_{79}	x_{80}
1024210	VM1698-4	43,35	43,28	43,41	43,56	43,68	43,22	43,37	43,72	43,35	43,77
1024210	VM1698-4	29,75	29,50	30,00	30,00	30,25	29,75	28,50	30,25	29,50	30,25

Machine Capability Study
Control System

Plant	ATG Westhausen		Operator Name	Sünder	Date 08.02.2022

Ser.No.	756028_h	Characteristic			
Type	1BD-1B060A-1K1D-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	43,36	43,57	43,30	43,64	43,42	43,58	43,26	43,57	43,67	43,56
1024210	VM1698-4	29,75	30,00	29,50	30,50	29,75	30,00	29,75	30,00	30,25	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	43,65	43,79	43,42	43,22	43,71	43,74	43,35	43,36	43,30	43,78
1024210	VM1698-4	30,25	30,25	28,25	29,50	30,50	30,25	29,75	29,75	29,50	30,25

Machine Capability Study
Tool System

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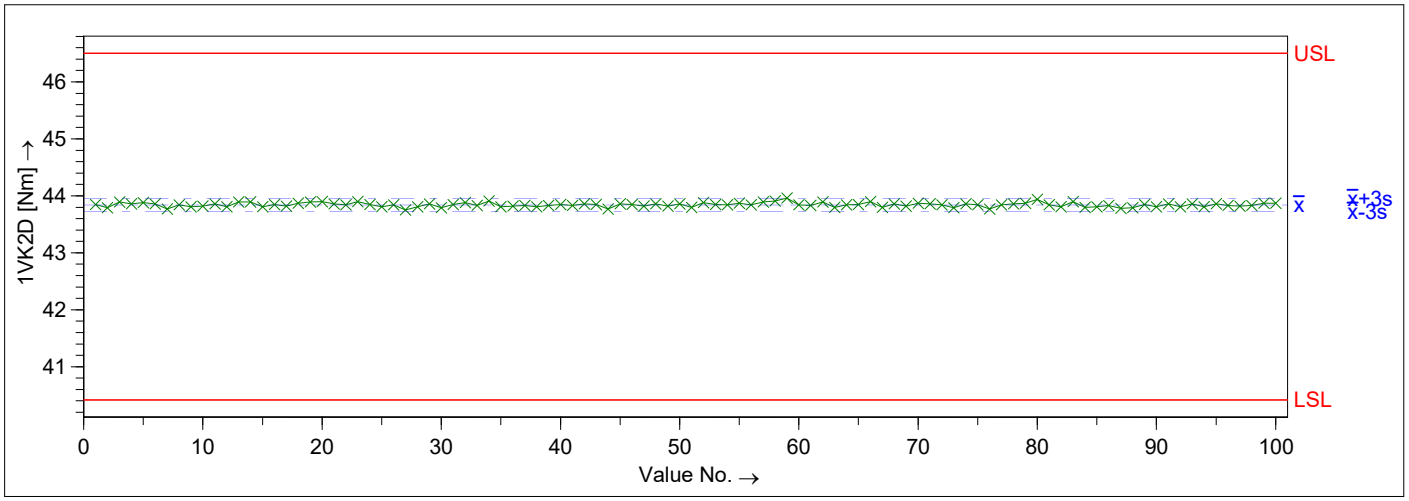
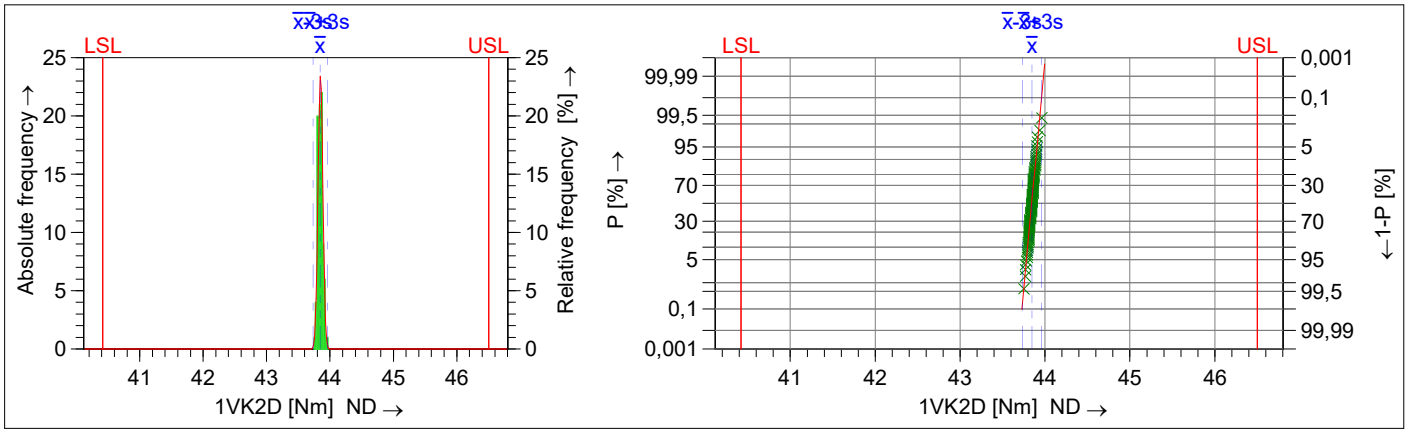
Plant	ATG Westhausen	Operator Name	Sünder
Date	08.02.2022		

Ord. No.	1BD53T2O-A	Part type	1BD-1B060A-1K1D-1VK2D	Contr.item	yes
Serial No.	756028_h	Char.Descr.	1VK2D	Inspection Val. 43,46 3,04	USL 46,50
		Serial No.	200693_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 08.02.2022 10:29:31 to 08.02.2022 10:44:49

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			$\bar{x}$	43.8432
LSL	40.42	x_{min}	43.75	$\bar{x}$-3s	43.7314
USL	46.50	x_{max}	43.96	$\bar{x}$+3s	43.9550
T	6.08	R	0.21	6s	0.2235
		$n_{<T>}$	100	$p_{<T>}$	100.00000 %
		$n_{>USL}$	0	$p_{>USL}$	0.00000%
		$n_{<LSL}$	0	$p_{<LSL}$	0.00000%
		n_{eff}	100		
		n_{tot}	100		

Model distribution			Normal Distribution
Calculation method			$M1_{1.4}$ $\hat{\sigma} = s_{tot}$
Potential Capability index	=	C_m	27.20
Critical capability index	=	C_{mk}	23.77

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

APEX VDI/VDE 2647 V0.1

Apex Tool Group GmbH \\htwe0006\AppData\QW\QWE\MessWert\2022\756028_h1.DFD

Machine Capability Study
Tool System

Plant	ATG Westhausen		Operator Name	Sünder	Date 08.02.2022

Ser.No.	756028_h	Characteristic			
Type	1BD-1B060A-1K1D-1VK2D	Char.Descr.	1VK2D	Inspection Val.	43,46
Ord. No.	1BD53T2O-A	Ser.No.	200693_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}
200693_	1VK2D	43,85	43,79	43,89	43,86	43,88	43,86	43,77	43,84	43,81	43,82
200693_	1VK2D	31,00	31,00	31,00	30,00	30,00	30,00	30,00	30,00	30,00	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}
200693_	1VK2D	43,86	43,81	43,89	43,89	43,81	43,85	43,82	43,87	43,89	43,90
200693_	1VK2D	31,00	31,00	31,00	30,00	31,00	31,00	30,00	30,00	30,00	31,00

Char.No.	Char.Descr.	x_{21}	x_{22}	x_{23}	x_{24}	x_{25}	x_{26}	x_{27}	x_{28}	x_{29}	x_{30}
200693_	1VK2D	43,86	43,84	43,90	43,85	43,81	43,84	43,75	43,81	43,86	43,79
200693_	1VK2D	31,00	31,00	31,00	30,00	30,00	31,00	31,00	31,00	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}
200693_	1VK2D	43,85	43,88	43,83	43,91	43,81	43,82	43,83	43,81	43,83	43,85
200693_	1VK2D	30,00	31,00	30,00	30,00	30,00	31,00	31,00	31,00	31,00	31,00

Char.No.	Char.Descr.	x_{41}	x_{42}	x_{43}	x_{44}	x_{45}	x_{46}	x_{47}	x_{48}	x_{49}	x_{50}
200693_	1VK2D	43,83	43,86	43,85	43,77	43,86	43,85	43,82	43,86	43,82	43,86
200693_	1VK2D	30,00	30,00	30,00	31,00	30,00	31,00	31,00	30,00	31,00	31,00

Char.No.	Char.Descr.	x_{51}	x_{52}	x_{53}	x_{54}	x_{55}	x_{56}	x_{57}	x_{58}	x_{59}	x_{60}
200693_	1VK2D	43,80	43,88	43,85	43,84	43,87	43,84	43,89	43,91	43,96	43,84
200693_	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}
200693_	1VK2D	43,83	43,89	43,80	43,84	43,85	43,90	43,80	43,86	43,82	43,87
200693_	1VK2D	30,00	31,00	30,00	31,00	30,00	31,00	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}
200693_	1VK2D	43,86	43,84	43,79	43,86	43,84	43,77	43,84	43,86	43,87	43,94
200693_	1VK2D	30,00	30,00	30,00	30,00	30,00	30,00	30,00	31,00	30,00	30,00

Machine Capability Study
Tool System

Plant	ATG Westhausen		Operator Name	Sünder	Date 08.02.2022

Ser.No.	756028_h	Characteristic			
Type	1BD-1B060A-1K1D-1VK2D	Char.Descr.	1VK2D	Inspection Val.	43,46
Ord. No.	1BD53T2O-A	Ser.No.	200693_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}
200693_	1VK2D	43,84	43,81	43,90	43,80	43,81	43,83	43,78	43,79	43,85	43,81
200693_	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}
200693_	1VK2D	43,86	43,81	43,86	43,81	43,86	43,83	43,82	43,83	43,87	43,87
200693_	1VK2D	30,00	30,00	30,00	30,00	30,00	31,00	30,00	30,00	30,00	30,00

Machine Capability Study
Tool System

Page 1 / 1

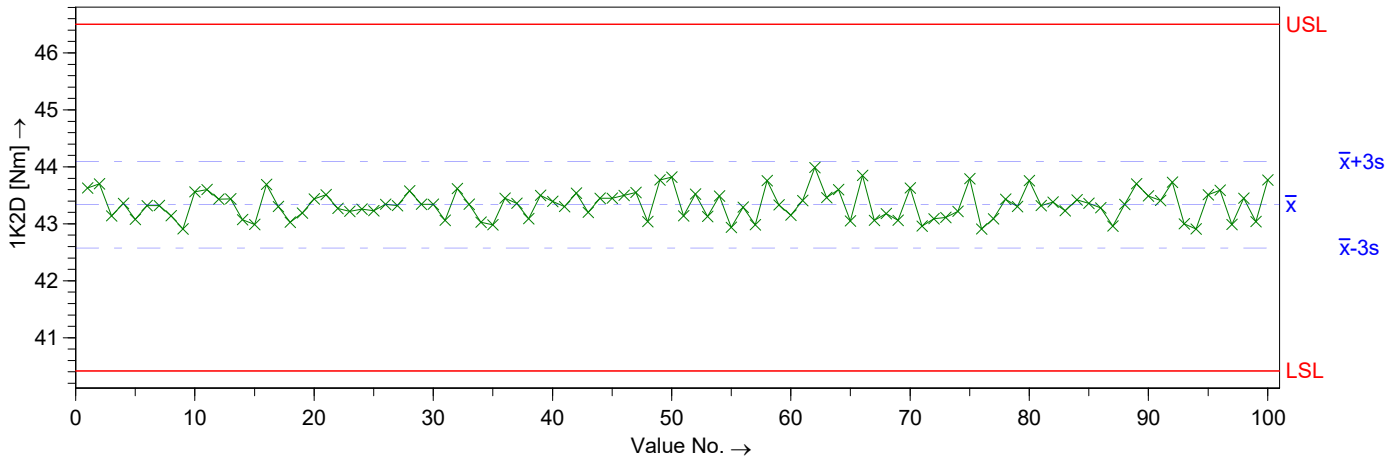
Plant ATG Westhausen		Operator Name Sünder	Date 08.02.2022

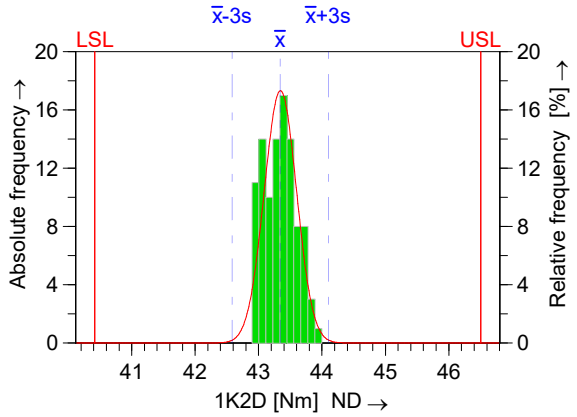
Ord. No. 1BD53T2O-A	Part type 1BD-1B060A-1K1D-1VK2D				Contr.item yes
Serial No. 756028_h	Char.Descr. 1K2D	Inspection Val.	43,46	3,04	USL 46,50
	Serial No. 202852	Unit	Nm	-3,04	LSL 40,42
Char.Type variable		Tolerance value	7 %		Decimal Pl. 2

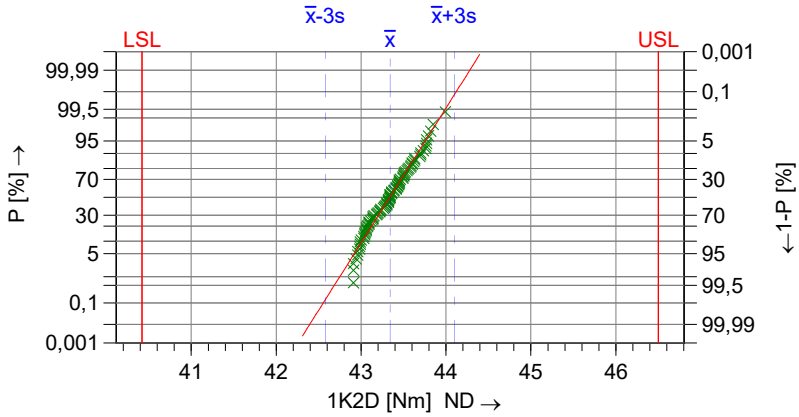
Cust.Name Cleco	Reference System VM1698-4	Test Electronic MPRO400GCD-P
Contr.No. Homologation	Reference Transducer 50 / 1024729	nges. 100

Evaluation from 08.02.2022 10:29:31 to 08.02.2022 10:44:49

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			$\bar{x}$	43.3375
LSL	40.42	x_{min}	42.91	$\bar{x}$-3s	42.5775
USL	46.50	x_{max}	43.99	$\bar{x}$+3s	44.0975
T	6.08	R	1.08	6s	1.5199
		$n_{<T>}$	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	4.00
Critical capability index	=	C_{mk}	3.84

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 08.02.2022

Ser.No.	756028_h	Characteristic			
Type	1BD-1B060A-1K1D-1VK2D	Char.Descr.	1K2D	Inspection Val.	43,46
Ord. No.	1BD53T2O-A	Ser.No.	202852	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}
202852	1K2D	43,63	43,70	43,14	43,36	43,08	43,32	43,32	43,14	42,91	43,56
202852	1K2D	31,00	31,00	31,00	30,00	30,00	30,00	30,00	30,00	30,00	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}
202852	1K2D	43,60	43,43	43,44	43,07	42,99	43,69	43,30	43,03	43,19	43,44
202852	1K2D	31,00	31,00	31,00	30,00	31,00	31,00	30,00	30,00	30,00	31,00

Char.No.	Char.Descr.	x_{21}	x_{22}	x_{23}	x_{24}	x_{25}	x_{26}	x_{27}	x_{28}	x_{29}	x_{30}
202852	1K2D	43,51	43,27	43,22	43,26	43,23	43,34	43,32	43,58	43,34	43,34
202852	1K2D	31,00	31,00	31,00	30,00	30,00	31,00	31,00	31,00	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}
202852	1K2D	43,06	43,62	43,34	43,03	42,98	43,45	43,36	43,09	43,50	43,39
202852	1K2D	30,00	31,00	30,00	30,00	30,00	31,00	31,00	31,00	31,00	31,00

Char.No.	Char.Descr.	x_{41}	x_{42}	x_{43}	x_{44}	x_{45}	x_{46}	x_{47}	x_{48}	x_{49}	x_{50}
202852	1K2D	43,30	43,54	43,20	43,45	43,45	43,50	43,55	43,04	43,77	43,82
202852	1K2D	30,00	30,00	30,00	31,00	30,00	31,00	31,00	30,00	31,00	31,00

Char.No.	Char.Descr.	x_{51}	x_{52}	x_{53}	x_{54}	x_{55}	x_{56}	x_{57}	x_{58}	x_{59}	x_{60}
202852	1K2D	43,14	43,52	43,13	43,49	42,94	43,29	42,98	43,76	43,33	43,15
202852	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}
202852	1K2D	43,41	43,99	43,46	43,60	43,05	43,85	43,06	43,18	43,06	43,63
202852	1K2D	30,00	31,00	30,00	31,00	30,00	31,00	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}
202852	1K2D	42,96	43,09	43,11	43,22	43,79	42,91	43,09	43,43	43,30	43,76
202852	1K2D	30,00	30,00	30,00	30,00	30,00	30,00	30,00	31,00	30,00	30,00

Machine Capability Study
Tool System

Plant	ATG Westhausen		Operator Name	Sünder	Date 08.02.2022

Ser.No.	756028_h	Characteristic			
Type	1BD-1B060A-1K1D-1VK2D	Char.Descr.	1K2D	Inspection Val.	43,46
Ord. No.	1BD53T2O-A	Ser.No.	202852	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}
202852	1K2D	43,32	43,38	43,23	43,42	43,36	43,28	42,96	43,34	43,70	43,49
202852	1K2D	30,00	30,00	30,00	30,00	30,00	30,00	30,00	30,00	30,00	30,00

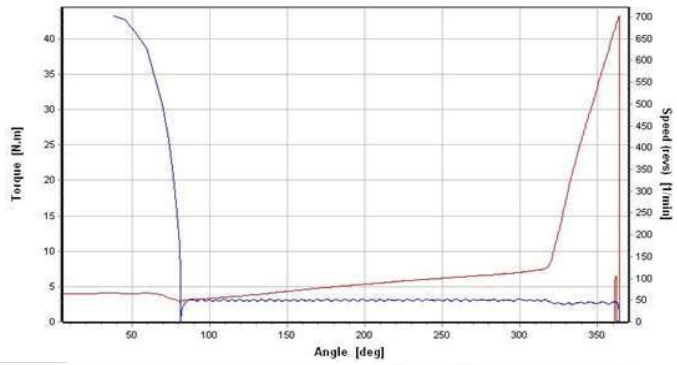
Char.No.	Char.Descr.	x_{91}	x_{92}	x_{93}	x_{94}	x_{95}	x_{96}	x_{97}	x_{98}	x_{99}	x_{100}
202852	1K2D	43,41	43,73	43,00	42,91	43,51	43,59	42,99	43,45	43,04	43,77
202852	1K2D	30,00	30,00	30,00	30,00	30,00	31,00	30,00	30,00	30,00	30,00

ue graphs

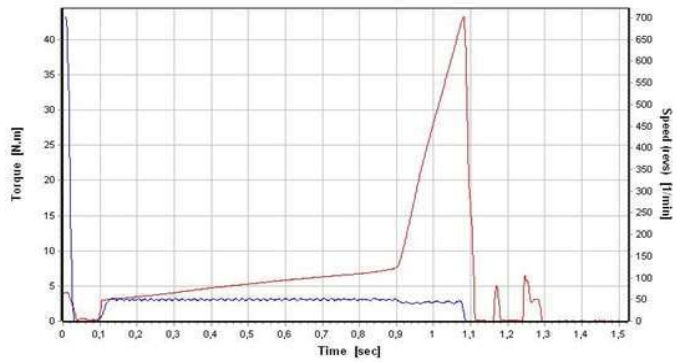
Machine Capability Study 80 %

Model: **1BD-1B060A-1K2D-1VK2D**
Serial no: **756028**

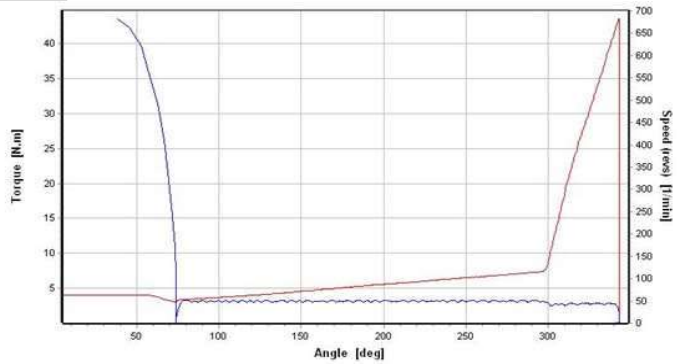
Angle degree: **30°**
Test torque: **43,5 Nm**



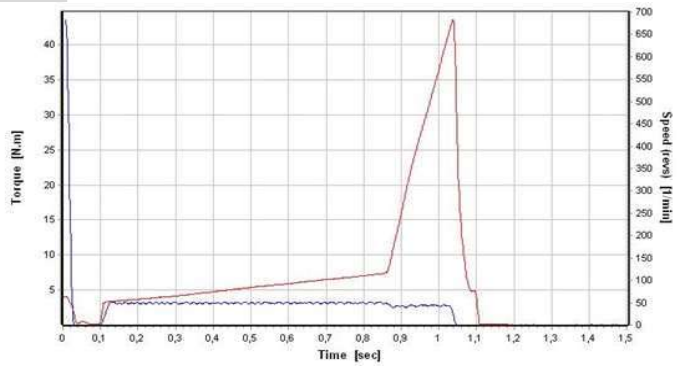
Value no. 1
Graph
Torque / Angle / Speed



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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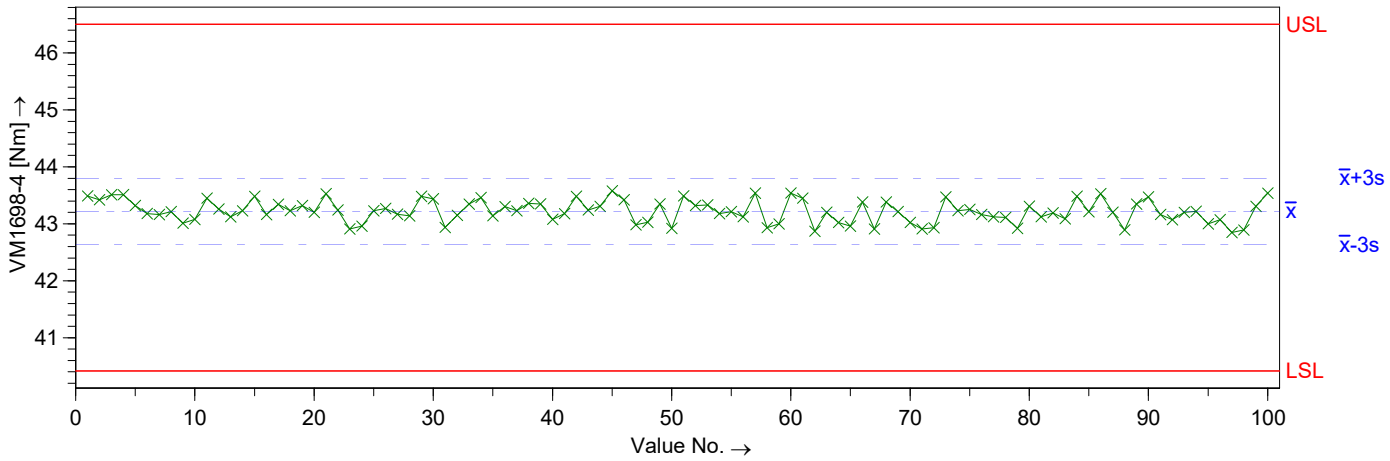
Plant ATG Westhausen		Operator Name Sünder	Date 08.02.2022

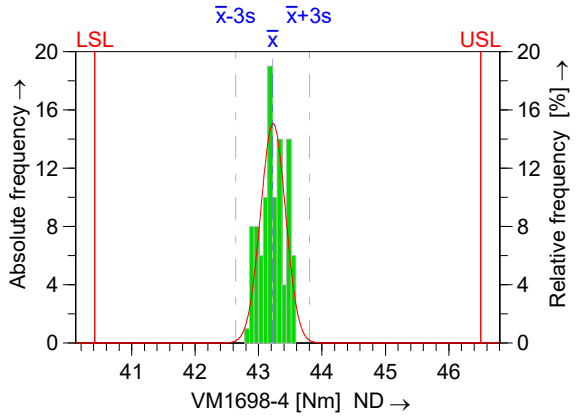
Ord. No. 1BD53T2O-A	Part type 1BD-1B060A-1K1D-1VK2D				Contr.item yes
Serial No. 756028_g	Char.Descr. VM1698-4	Inspection Val.	43,46	3,04	USL 46,50
	Serial No. 1024210	Unit	Nm	-3,04	LSL 40,42
Char.Type variable		Tolerance value	7 %		Decimal Pl. 2

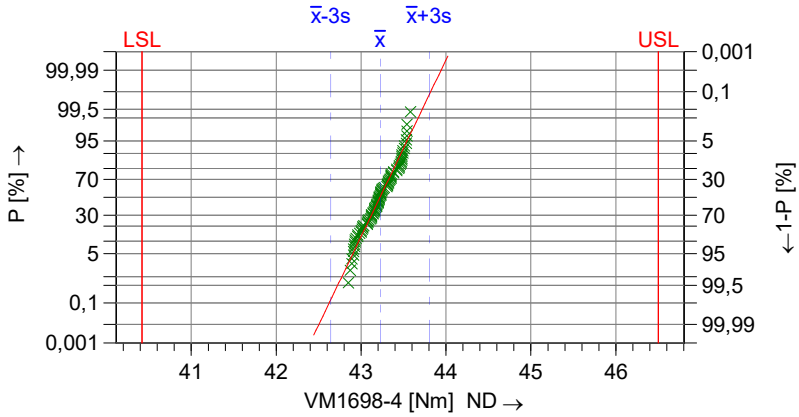
Cust.Name Cleco	Reference System VM1698-4	Test Electronic MPRO400GCD-P
Contr.No. Homologation	Reference Transducer 50 / 1024729	nges. 100

Evaluation from 08.02.2022 08:18:57 to 08.02.2022 08:45:41

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







Drawing Values		Collected Values		Statistics	
T_m	43.46			x̄	43.2221
LSL	40.42	x_{min}	42.85	x̄-3s	42.6422
USL	46.50	x_{max}	43.58	x̄+3s	43.8020
T	6.08	R	0.73	6s	1.1598
		$n_{<T>}$	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	5.24
Critical capability index	=	C_{mk}	4.83

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 08.02.2022

Ser.No.	756028_g	Characteristic			
Type	1BD-1B060A-1K1D-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	43,49	43,42	43,51	43,51	43,32	43,18	43,16	43,21	43,01	43,08
1024210	VM1698-4	366,00	363,25	363,00	367,75	365,50	361,25	355,50	354,25	358,25	360,00

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	43,45	43,26	43,12	43,23	43,48	43,16	43,34	43,23	43,32	43,20
1024210	VM1698-4	367,25	363,25	359,25	360,50	367,75	357,00	360,25	357,50	363,25	363,25

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	43,53	43,24	42,91	42,96	43,23	43,27	43,17	43,14	43,48	43,44
1024210	VM1698-4	369,25	361,00	358,50	356,75	360,00	362,25	359,50	358,25	367,75	367,25

Char.No.	Char.Descr.	x_{31}	x_{32}	x_{33}	x_{34}	x_{35}	x_{36}	x_{37}	x_{38}	x_{39}	x_{40}
1024210	VM1698-4	42,94	43,15	43,35	43,46	43,14	43,30	43,23	43,36	43,35	43,08
1024210	VM1698-4	363,50	363,00	366,50	365,50	366,00	365,50	364,00	367,00	363,75	363,75

Char.No.	Char.Descr.	x_{41}	x_{42}	x_{43}	x_{44}	x_{45}	x_{46}	x_{47}	x_{48}	x_{49}	x_{50}
1024210	VM1698-4	43,18	43,48	43,24	43,31	43,58	43,42	42,98	43,03	43,35	42,92
1024210	VM1698-4	365,25	370,00	365,75	366,50	371,00	361,00	359,50	358,50	367,00	355,50

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	43,49	43,32	43,33	43,18	43,21	43,12	43,54	42,93	43,00	43,54
1024210	VM1698-4	368,00	367,50	363,25	363,75	364,50	364,00	371,75	362,50	367,00	371,75

Char.No.	Char.Descr.	x_{61}	x_{62}	x_{63}	x_{64}	x_{65}	x_{66}	x_{67}	x_{68}	x_{69}	x_{70}
1024210	VM1698-4	43,45	42,87	43,20	43,02	42,96	43,38	42,91	43,38	43,21	43,02
1024210	VM1698-4	370,75	357,00	365,50	365,25	362,50	368,00	360,00	371,50	362,25	361,00

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	42,91	42,93	43,47	43,23	43,25	43,16	43,12	43,11	42,92	43,31
1024210	VM1698-4	358,75	363,75	370,00	360,25	360,50	359,50	359,00	358,50	359,00	365,75

Machine Capability Study
Control System

Plant	ATG Westhausen		Operator Name	Sünder	Date 08.02.2022

Ser.No.	756028_g	Characteristic			
Type	1BD-1B060A-1K1D-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	43,12	43,19	43,09	43,48	43,21	43,53	43,20	42,89	43,35	43,47
1024210	VM1698-4	366,50	363,75	364,75	369,00	364,50	374,50	353,75	357,00	357,00	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	43,16	43,07	43,20	43,22	43,00	43,07	42,85	42,89	43,31	43,54
1024210	VM1698-4	353,25	357,25	356,00	353,00	350,00	354,75	350,50	351,50	367,25	369,50

Machine Capability Study
Tool System

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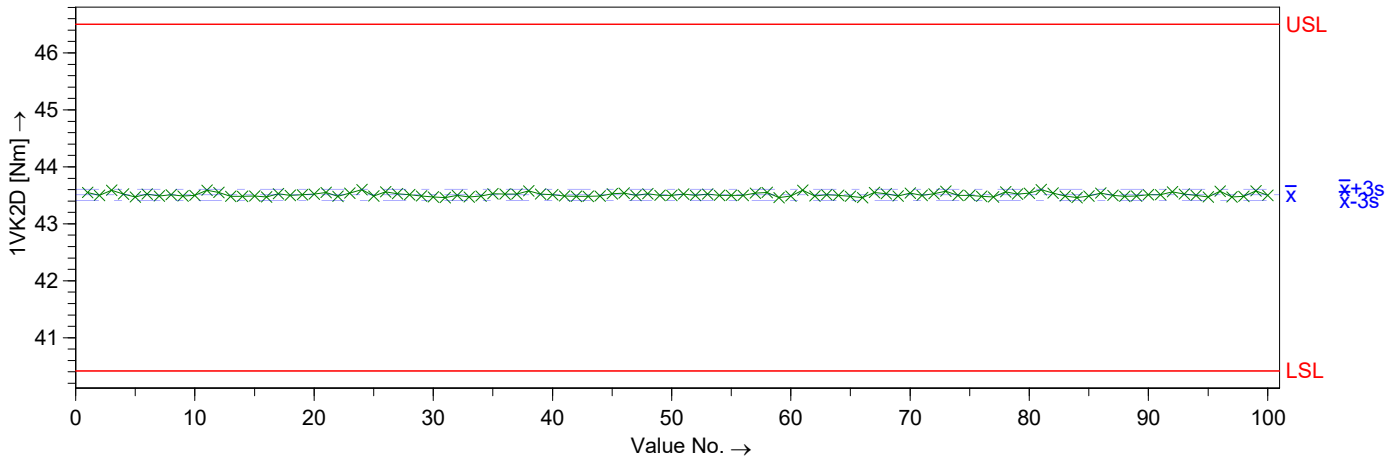
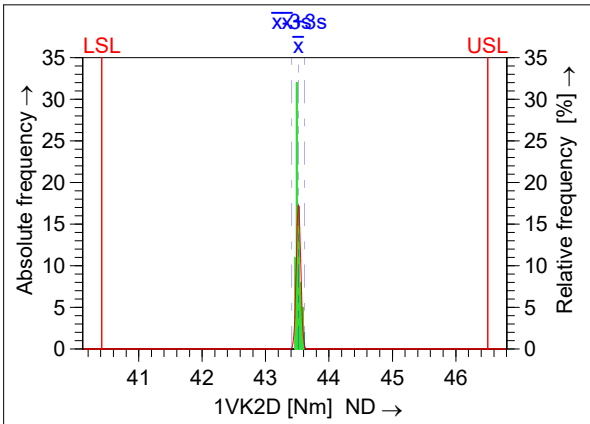
Plant	ATG Westhausen	Operator Name	Sünder
Date	08.02.2022		

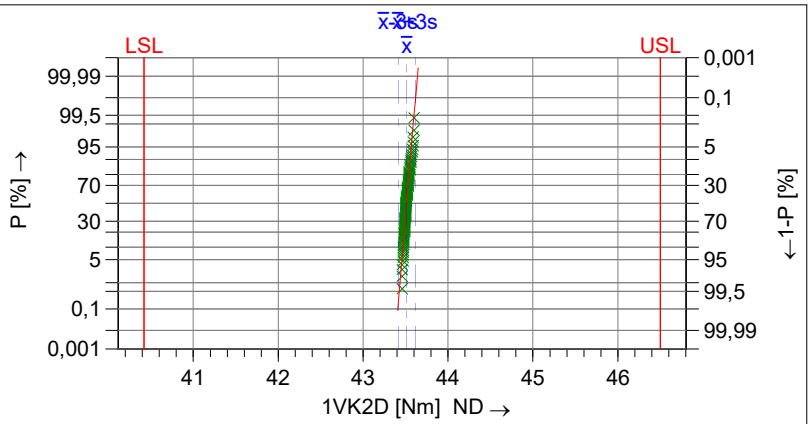
Ord. No.	1BD53T2O-A	Part type	1BD-1B060A-1K1D-1VK2D	Contr.item	yes
Serial No.	756028_g	Char.Descr.	1VK2D	Inspection Val. 43,46 3,04	USL 46,50
		Serial No.	200693_1	Unit Nm -3,04	LSL 40,42
Char.Type	variable			Tolerance value 7 %	Decimal Pl. 2
Cust.Name	Cleco	Reference System	VM1698-4	Test Electronic	MPRO400GCD-P
Contr.No.	Homologation	Reference Transducer	50 / 1024729	nges.	100

Evaluation from 08.02.2022 08:18:58 to 08.02.2022 08:45:42

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			$\bar{x}$	43.5127
LSL	40.42	x_{min}	43.46	$\bar{x}$-3s	43.4109
USL	46.50	x_{max}	43.60	$\bar{x}$+3s	43.6145
T	6.08	R	0.14	6s	0.2036
		$n_{<T>}$	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	29.87
Critical capability index	=	C_{mk}	29.35

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

APEX VDI/VDE 2647 V0.1

Apex Tool Group GmbH \\htwe0006\AppData\QW\QWE\MessWert\2022\756028_g1.DFD

Machine Capability Study
Tool System

Plant	ATG Westhausen		Operator Name	Sünder	Date 08.02.2022

Ser.No.	756028_g	Characteristic			
Type	1BD-1B060A-1K1D-1VK2D	Char.Descr.	1VK2D	Inspection Val.	43,46
Ord. No.	1BD53T2O-A	Ser.No.	200693_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}
200693_	1VK2D	43,55	43,50	43,59	43,52	43,47	43,52	43,49	43,51	43,49	43,50
200693_	1VK2D	366,00	364,00	363,00	367,00	367,00	364,00	357,00	357,00	363,00	365,00

Char.No.	Char.Descr.	x_{11}	x_{12}	x_{13}	x_{14}	x_{15}	x_{16}	x_{17}	x_{18}	x_{19}	x_{20}
200693_	1VK2D	43,59	43,55	43,48	43,48	43,49	43,47	43,53	43,50	43,51	43,52
200693_	1VK2D	369,00	365,00	362,00	363,00	367,00	359,00	361,00	360,00	366,00	365,00

Char.No.	Char.Descr.	x_{21}	x_{22}	x_{23}	x_{24}	x_{25}	x_{26}	x_{27}	x_{28}	x_{29}	x_{30}
200693_	1VK2D	43,55	43,48	43,54	43,60	43,49	43,56	43,53	43,51	43,49	43,47
200693_	1VK2D	370,00	363,00	364,00	363,00	362,00	365,00	363,00	362,00	367,00	368,00

Char.No.	Char.Descr.	x_{31}	x_{32}	x_{33}	x_{34}	x_{35}	x_{36}	x_{37}	x_{38}	x_{39}	x_{40}
200693_	1VK2D	43,46	43,50	43,47	43,49	43,53	43,52	43,52	43,58	43,52	43,51
200693_	1VK2D	369,00	366,00	367,00	366,00	372,00	368,00	366,00	369,00	365,00	367,00

Char.No.	Char.Descr.	x_{41}	x_{42}	x_{43}	x_{44}	x_{45}	x_{46}	x_{47}	x_{48}	x_{49}	x_{50}
200693_	1VK2D	43,49	43,48	43,48	43,49	43,53	43,54	43,50	43,53	43,50	43,50
200693_	1VK2D	369,00	370,00	368,00	367,00	371,00	362,00	365,00	363,00	369,00	363,00

Char.No.	Char.Descr.	x_{51}	x_{52}	x_{53}	x_{54}	x_{55}	x_{56}	x_{57}	x_{58}	x_{59}	x_{60}
200693_	1VK2D	43,52	43,50	43,52	43,50	43,50	43,50	43,54	43,55	43,46	43,49
200693_	1VK2D	367,00	369,00	364,00	366,00	368,00	368,00	371,00	367,00	373,00	371,00

Char.No.	Char.Descr.	x_{61}	x_{62}	x_{63}	x_{64}	x_{65}	x_{66}	x_{67}	x_{68}	x_{69}	x_{70}
200693_	1VK2D	43,59	43,49	43,51	43,50	43,48	43,46	43,55	43,53	43,49	43,54
200693_	1VK2D	372,00	362,00	367,00	369,00	367,00	373,00	366,00	373,00	365,00	366,00

Char.No.	Char.Descr.	x_{71}	x_{72}	x_{73}	x_{74}	x_{75}	x_{76}	x_{77}	x_{78}	x_{79}	x_{80}
200693_	1VK2D	43,50	43,53	43,57	43,50	43,50	43,48	43,47	43,56	43,52	43,54
200693_	1VK2D	364,00	369,00	371,00	362,00	363,00	364,00	362,00	362,00	365,00	367,00

Machine Capability Study
Tool System

Plant	ATG Westhausen		Operator Name	Sünder	Date 08.02.2022

Ser.No.	756028_g	Characteristic			
Type	1BD-1B060A-1K1D-1VK2D	Char.Descr.	1VK2D	Inspection Val.	43,46
Ord. No.	1BD53T2O-A	Ser.No.	200693_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}
200693_	1VK2D	43,60	43,54	43,49	43,46	43,49	43,54	43,50	43,48	43,49	43,51
200693_	1VK2D	372,00	367,00	369,00	369,00	367,00	375,00	357,00	363,00	358,00	360,00

Char.No.	Char.Descr.	x_{91}	x_{92}	x_{93}	x_{94}	x_{95}	x_{96}	x_{97}	x_{98}	x_{99}	x_{100}
200693_	1VK2D	43,51	43,56	43,52	43,50	43,47	43,57	43,47	43,48	43,58	43,50
200693_	1VK2D	358,00	361,00	359,00	356,00	356,00	359,00	358,00	356,00	371,00	369,00

Machine Capability Study
Tool System

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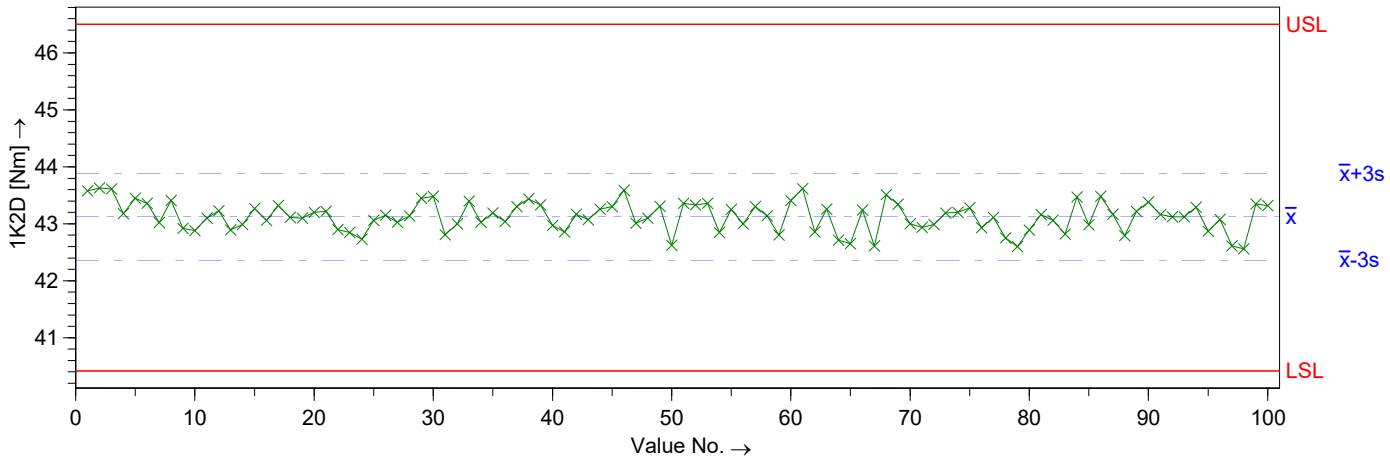
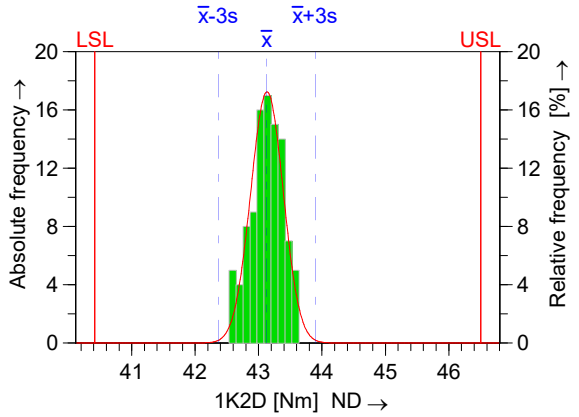
Plant	ATG Westhausen	Operator Name	Sünder
Date	08.02.2022		

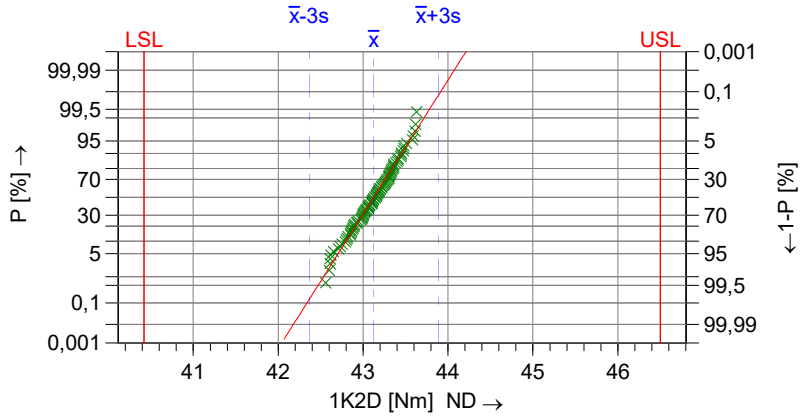
Ord. No.	1BD53T2O-A	Part type	1BD-1B060A-1K1D-1VK2D	Contr.item	yes
Serial No.	756028_g	Char.Descr.	1K2D	Inspection Val. 43,46 3,04	USL 46,50
		Serial No.	202852	Unit Nm -3,04	LSL 40,42
Char.Type	variable			Tolerance value 7 %	Decimal Pl. 2
Cust.Name	Cleco	Reference System	VM1698-4	Test Electronic	MPRO400GCD-P
Contr.No.	Homologation	Reference Transducer	50 / 1024729	nges.	100

Evaluation from 08.02.2022 08:18:58 to 08.02.2022 08:45:42

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			$\bar{x}$	43.1261
LSL	40.42	x_{min}	42.56	$\bar{x}$-3s	42.3626
USL	46.50	x_{max}	43.63	$\bar{x}$+3s	43.8896
T	6.08	R	1.07	6s	1.5270
		$n_{<T>}$	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	3.98
Critical capability index	=	C_{mk}	3.54

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 08.02.2022

Ser.No.	756028_g	Characteristic			
Type	1BD-1B060A-1K1D-1VK2D	Char.Descr.	1K2D	Inspection Val.	43,46
Ord. No.	1BD53T2O-A	Ser.No.	202852	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}
202852	1K2D	43,58	43,63	43,61	43,18	43,45	43,36	43,02	43,41	42,92	42,88
202852	1K2D	366,00	364,00	363,00	367,00	367,00	364,00	357,00	357,00	363,00	365,00

Char.No.	Char.Descr.	x_{11}	x_{12}	x_{13}	x_{14}	x_{15}	x_{16}	x_{17}	x_{18}	x_{19}	x_{20}
202852	1K2D	43,10	43,23	42,89	42,99	43,27	43,06	43,32	43,11	43,10	43,20
202852	1K2D	369,00	365,00	362,00	363,00	367,00	359,00	361,00	360,00	366,00	365,00

Char.No.	Char.Descr.	x_{21}	x_{22}	x_{23}	x_{24}	x_{25}	x_{26}	x_{27}	x_{28}	x_{29}	x_{30}
202852	1K2D	43,22	42,90	42,85	42,73	43,06	43,15	43,03	43,14	43,45	43,48
202852	1K2D	370,00	363,00	364,00	363,00	362,00	365,00	363,00	362,00	367,00	368,00

Char.No.	Char.Descr.	x_{31}	x_{32}	x_{33}	x_{34}	x_{35}	x_{36}	x_{37}	x_{38}	x_{39}	x_{40}
202852	1K2D	42,81	43,00	43,40	43,03	43,19	43,04	43,30	43,44	43,33	42,97
202852	1K2D	369,00	366,00	367,00	366,00	372,00	368,00	366,00	369,00	365,00	367,00

Char.No.	Char.Descr.	x_{41}	x_{42}	x_{43}	x_{44}	x_{45}	x_{46}	x_{47}	x_{48}	x_{49}	x_{50}
202852	1K2D	42,86	43,17	43,07	43,26	43,30	43,59	43,01	43,10	43,31	42,62
202852	1K2D	369,00	370,00	368,00	367,00	371,00	362,00	365,00	363,00	369,00	363,00

Char.No.	Char.Descr.	x_{51}	x_{52}	x_{53}	x_{54}	x_{55}	x_{56}	x_{57}	x_{58}	x_{59}	x_{60}
202852	1K2D	43,36	43,33	43,36	42,85	43,25	43,00	43,30	43,14	42,80	43,41
202852	1K2D	367,00	369,00	364,00	366,00	368,00	368,00	371,00	367,00	373,00	371,00

Char.No.	Char.Descr.	x_{61}	x_{62}	x_{63}	x_{64}	x_{65}	x_{66}	x_{67}	x_{68}	x_{69}	x_{70}
202852	1K2D	43,62	42,86	43,26	42,71	42,65	43,24	42,61	43,51	43,34	43,00
202852	1K2D	372,00	362,00	367,00	369,00	367,00	373,00	366,00	373,00	365,00	366,00

Char.No.	Char.Descr.	x_{71}	x_{72}	x_{73}	x_{74}	x_{75}	x_{76}	x_{77}	x_{78}	x_{79}	x_{80}
202852	1K2D	42,94	42,99	43,19	43,20	43,28	42,93	43,11	42,75	42,60	42,89
202852	1K2D	364,00	369,00	371,00	362,00	363,00	364,00	362,00	362,00	365,00	367,00

Machine Capability Study
Tool System

Plant	ATG Westhausen		Operator Name	Sünder	Date 08.02.2022

Ser.No.	756028_g	Characteristic			
Type	1BD-1B060A-1K1D-1VK2D	Char.Descr.	1K2D	Inspection Val.	43,46
Ord. No.	1BD53T2O-A	Ser.No.	202852	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}
202852	1K2D	43,16	43,06	42,82	43,47	42,98	43,48	43,17	42,79	43,22	43,38
202852	1K2D	372,00	367,00	369,00	369,00	367,00	375,00	357,00	363,00	358,00	360,00

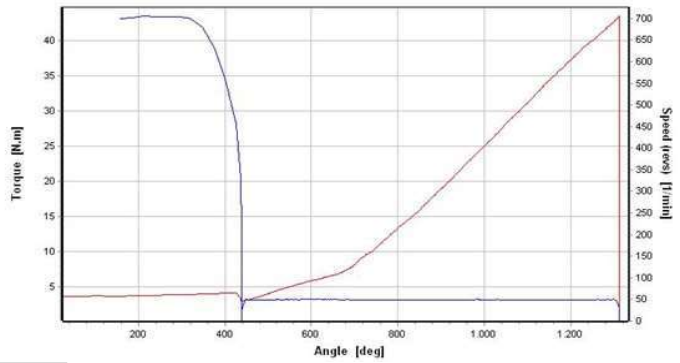
Char.No.	Char.Descr.	x_{91}	x_{92}	x_{93}	x_{94}	x_{95}	x_{96}	x_{97}	x_{98}	x_{99}	x_{100}
202852	1K2D	43,16	43,12	43,12	43,29	42,87	43,08	42,61	42,56	43,35	43,32
202852	1K2D	358,00	361,00	359,00	356,00	356,00	359,00	358,00	356,00	371,00	369,00

ue graphs

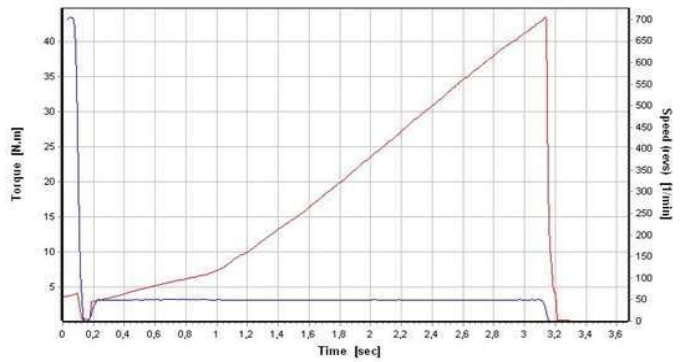
Machine Capability Study 80 %

Model: **1BD-1B060A-1K2D-1VK2D**
Serial no: **756028**

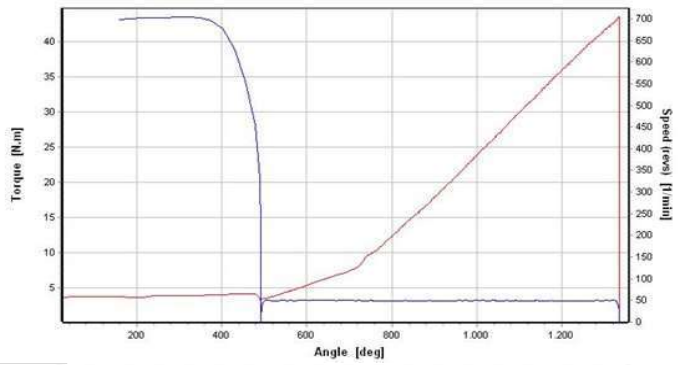
Angle degree: **360°**
Test torque: **43,5 Nm**



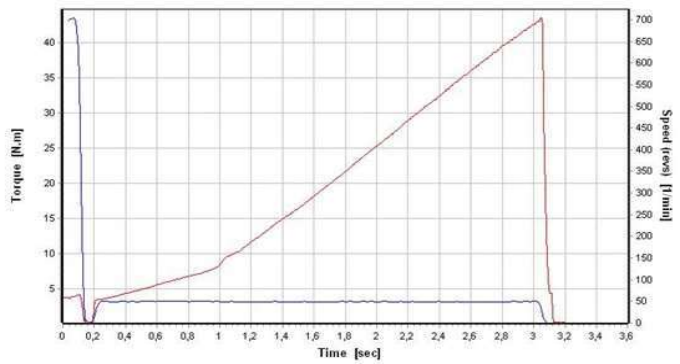
Value no. 1
Graph
Torque / Angle / Speed



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: **756028**

Test torque: Tq max. 53,00 Nm

Hard joint (H)	318,20	Nm / Revolution	Angle degree	30°
Soft joint (L)	26,25	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	53,03	52,50 Nm
	Standard deviation	0,25	0,30 Nm
	Torque scatter (99,73%)	1,50	1,81 Nm
	C_m	4,96	4,10
	C_{mk}	4,91	3,54

b)	Min. C_m hard/soft (lowest value)	4,10
	Min. C_{mk} hard/soft (lowest value)	3,54

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

Note:

Machine Capability Study
Control System

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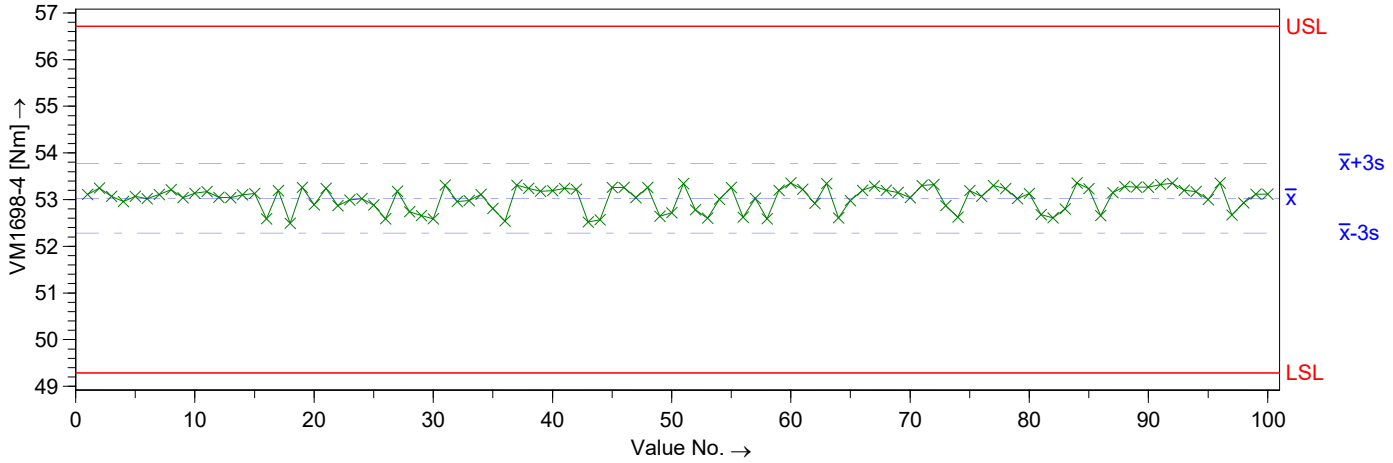
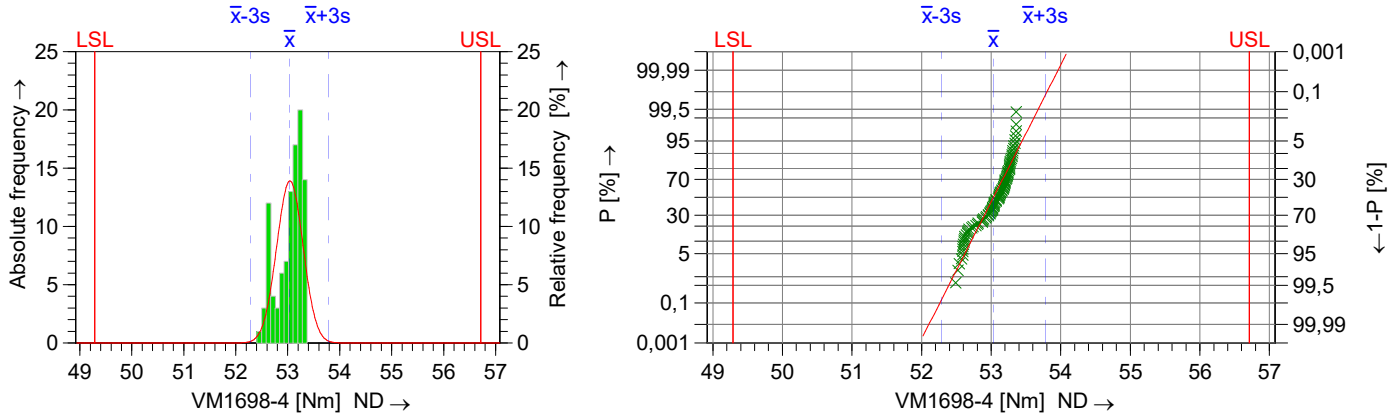
Plant	ATG Westhausen	Operator Name	Sünder
Date	08.02.2022		

Ord. No.	1BD53T2O-A	Part type	1BD-1B060A-1K1D-1VK2D	Contr.item	yes
Serial No.	756028_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 08.02.2022 07:18:00 to 08.02.2022 07:33:38

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			$\bar{x}$	53.0335
LSL	49.29	x_{min}	52.49	$\bar{x}$-3s	52.2854
USL	56.71	x_{max}	53.36	$\bar{x}$+3s	53.7816
T	7.42	R	0.87	6s	1.4962
		$n_{<T>}$	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	4.96
Critical capability index	=	C_{mk}	4.91

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 08.02.2022

Ser.No.	756028_b	Characteristic			
Type	1BD-1B060A-1K1D-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	53,11	53,25	53,07	52,96	53,07	53,02	53,11	53,21	53,04	53,14
1024210	VM1698-4	30,50	30,75	30,75	30,75	31,25	31,00	31,25	31,00	31,00	30,75

Char.No.	Char.Descr.	x_{11}	x_{12}	x_{13}	x_{14}	x_{15}	x_{16}	x_{17}	x_{18}	x_{19}	x_{20}
1024210	VM1698-4	53,17	53,05	53,04	53,10	53,13	52,59	53,19	52,49	53,26	52,89
1024210	VM1698-4	30,75	30,75	30,50	31,00	30,25	29,50	30,25	29,75	30,50	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	53,24	52,87	52,99	53,02	52,88	52,59	53,18	52,74	52,66	52,59
1024210	VM1698-4	30,50	30,00	30,50	30,25	30,25	30,00	31,00	30,00	30,00	29,75

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	52,96	52,98	53,11	52,81	52,54	53,31	53,24	53,18	53,19
1024210	VM1698-4	30,50	29,75	29,75	30,25	29,75	29,75	30,50	30,75	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	53,24	53,22	52,52	52,57	53,26	53,26	53,04	53,26	52,64	52,72
1024210	VM1698-4	30,75	31,00	30,00	30,00	30,75	30,50	30,75	31,00	30,25	30,50

Char.No.	Char.Descr.	x_{51}	x_{52}	x_{53}	x_{54}	x_{55}	x_{56}	x_{57}	x_{58}	x_{59}	x_{60}
1024210	VM1698-4	53,34	52,78	52,60	53,01	53,26	52,62	53,03	52,59	53,20	53,36
1024210	VM1698-4	31,00	30,00	29,75	28,75	30,75	28,25	30,75	29,75	30,75	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}
1024210	VM1698-4	53,22	52,92	53,34	52,61	52,98	53,20	53,29	53,20	53,15	53,04
1024210	VM1698-4	31,00	30,75	30,25	29,75	30,25	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	53,30	53,32	52,87	52,62	53,19	53,07	53,30	53,23	53,02	53,13
1024210	VM1698-4	30,50	30,50	29,75	29,50	30,25	30,00	29,00	30,25	30,25	30,50

Machine Capability Study
Control System

Plant	ATG Westhausen		Operator Name	Sünder	Date 08.02.2022

Ser.No.	756028_b	Characteristic			
Type	1BD-1B060A-1K1D-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	52,68	52,61	52,80	53,36	53,23	52,66	53,15	53,28	53,27	53,27
1024210	VM1698-4	29,75	29,50	29,75	30,50	30,75	29,75	30,75	30,50	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	53,32	53,35	53,20	53,17	53,00	53,36	52,67	52,93	53,12	53,12
1024210	VM1698-4	30,75	30,50	30,25	30,00	30,25	30,50	29,50	30,00	30,50	30,50

Machine Capability Study
Tool System

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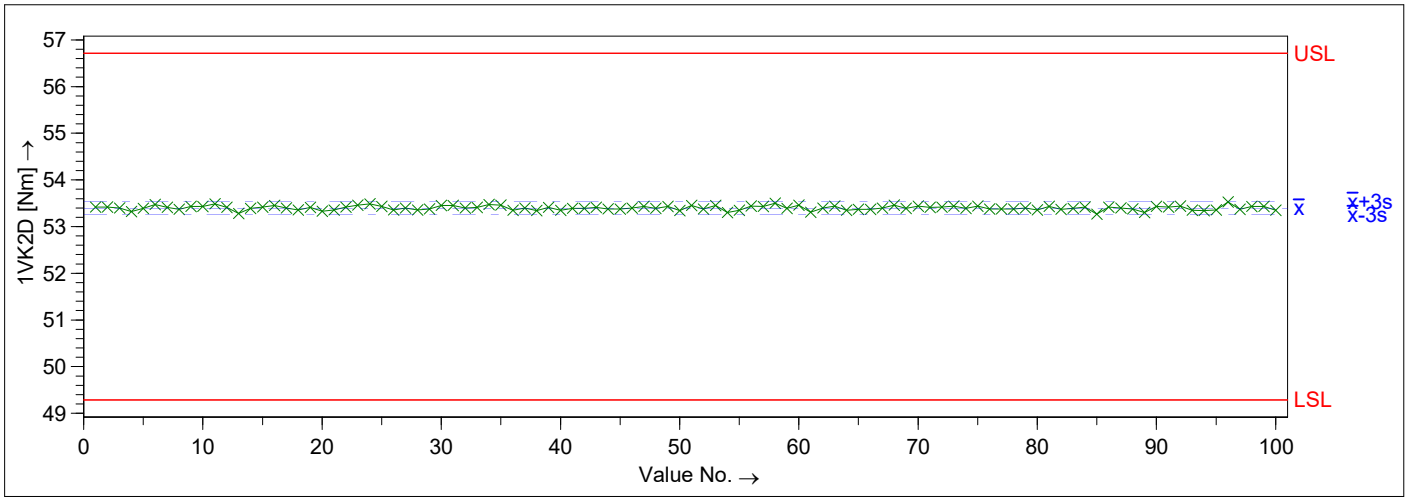
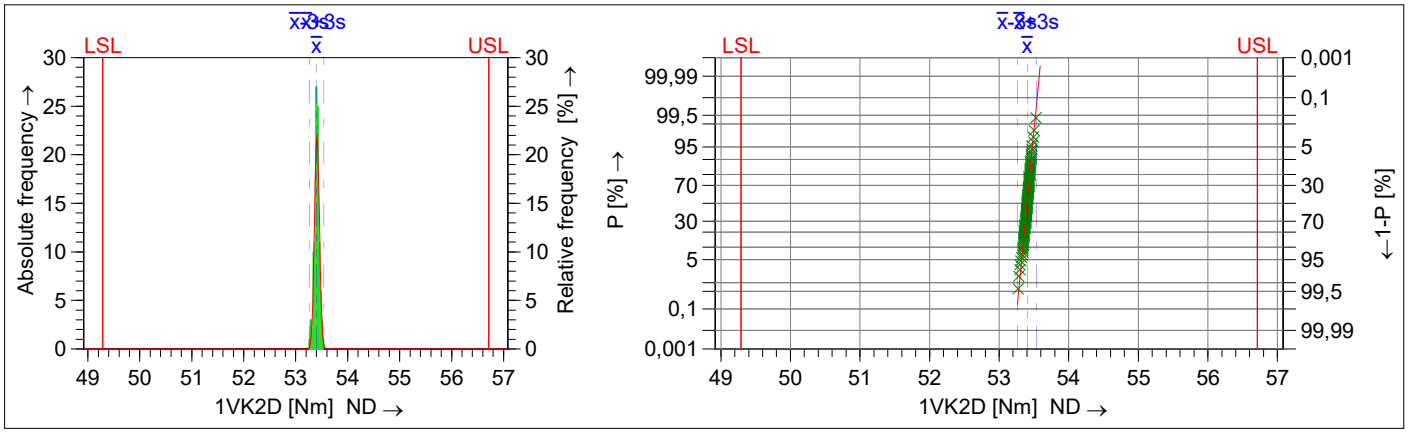
Plant	ATG Westhausen	Operator Name	Sünder
Date	08.02.2022		

Ord. No.	1BD53T2O-A	Part type	1BD-1B060A-1K1D-1VK2D	Contr.item	yes
Serial No.	756028_b	Char.Descr.	1VK2D	Inspection Val. 53,00 3,71	USL 56,71
		Serial No.	200693_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 08.02.2022 07:18:01 to 08.02.2022 07:33:39

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			$\bar{x}$	53.4000
LSL	49.29	x_{min}	53.27	$\bar{x}$-3s	53.2595
USL	56.71	x_{max}	53.53	$\bar{x}$+3s	53.5405
T	7.42	R	0.26	6s	0.2809
		$n_{<T>}$	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}	23.57

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

APEX VDI/VDE 2647 V0.1

Apex Tool Group GmbH \\htwe0006\AppData\QW\QWE\MessWert\2022\756028_b1.DFD

Machine Capability Study
Tool System

Plant	ATG Westhausen		Operator Name	Sünder	Date 08.02.2022

Ser.No.	756028_b	Characteristic			
Type	1BD-1B060A-1K1D-1VK2D	Char.Descr.	1VK2D	Inspection Val.	53,00
Ord. No.	1BD53T2O-A	Ser.No.	200693_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}
200693_	1VK2D	53,42	53,42	53,40	53,32	53,39	53,47	53,41	53,37	53,43	53,43
200693_	1VK2D	31,00	31,00	31,00	31,00	31,00	31,00	32,00	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}
200693_	1VK2D	53,49	53,41	53,28	53,39	53,42	53,45	53,40	53,36	53,41	53,33
200693_	1VK2D	31,00	31,00	31,00	31,00	30,00	30,00	30,00	30,00	31,00	31,00

Char.No.	Char.Descr.	x_{21}	x_{22}	x_{23}	x_{24}	x_{25}	x_{26}	x_{27}	x_{28}	x_{29}	x_{30}
200693_	1VK2D	53,36	53,42	53,46	53,49	53,43	53,36	53,40	53,36	53,38	53,45
200693_	1VK2D	31,00	31,00	31,00	31,00	31,00	30,00	31,00	30,00	30,00	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}
200693_	1VK2D	53,45	53,40	53,41	53,47	53,46	53,35	53,40	53,34	53,41	53,35
200693_	1VK2D	31,00	30,00	30,00	30,00	30,00	30,00	31,00	31,00	31,00	31,00

Char.No.	Char.Descr.	x_{41}	x_{42}	x_{43}	x_{44}	x_{45}	x_{46}	x_{47}	x_{48}	x_{49}	x_{50}
200693_	1VK2D	53,39	53,39	53,41	53,38	53,38	53,40	53,43	53,39	53,43	53,34
200693_	1VK2D	31,00	31,00	31,00	30,00	31,00	31,00	31,00	31,00	31,00	31,00

Char.No.	Char.Descr.	x_{51}	x_{52}	x_{53}	x_{54}	x_{55}	x_{56}	x_{57}	x_{58}	x_{59}	x_{60}
200693_	1VK2D	53,45	53,38	53,45	53,30	53,35	53,44	53,43	53,50	53,39	53,46
200693_	1VK2D	31,00	30,00	30,00	30,00	31,00	30,00	31,00	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}
200693_	1VK2D	53,31	53,40	53,44	53,35	53,37	53,37	53,40	53,46	53,39	53,44
200693_	1VK2D	31,00	31,00	30,00	30,00	31,00	30,00	31,00	30,00	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}
200693_	1VK2D	53,41	53,42	53,44	53,39	53,44	53,38	53,38	53,38	53,40	53,36
200693_	1VK2D	30,00	31,00	30,00	30,00	30,00	30,00	30,00	31,00	31,00	31,00

Machine Capability Study
Tool System

Plant	ATG Westhausen		Operator Name	Sünder	Date 08.02.2022

Ser.No.	756028_b	Characteristic			
Type	1BD-1B060A-1K1D-1VK2D	Char.Descr.	1VK2D	Inspection Val.	53,00
Ord. No.	1BD53T2O-A	Ser.No.	200693_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}
200693_	1VK2D	53,43	53,37	53,39	53,42	53,27	53,42	53,40	53,38	53,30	53,43
200693_	1VK2D	30,00	30,00	30,00	31,00	31,00	30,00	30,00	31,00	31,00	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}
200693_	1VK2D	53,42	53,44	53,35	53,34	53,36	53,53	53,37	53,43	53,43	53,35
200693_	1VK2D	31,00	31,00	30,00	30,00	31,00	31,00	30,00	31,00	30,00	30,00

Machine Capability Study
Tool System

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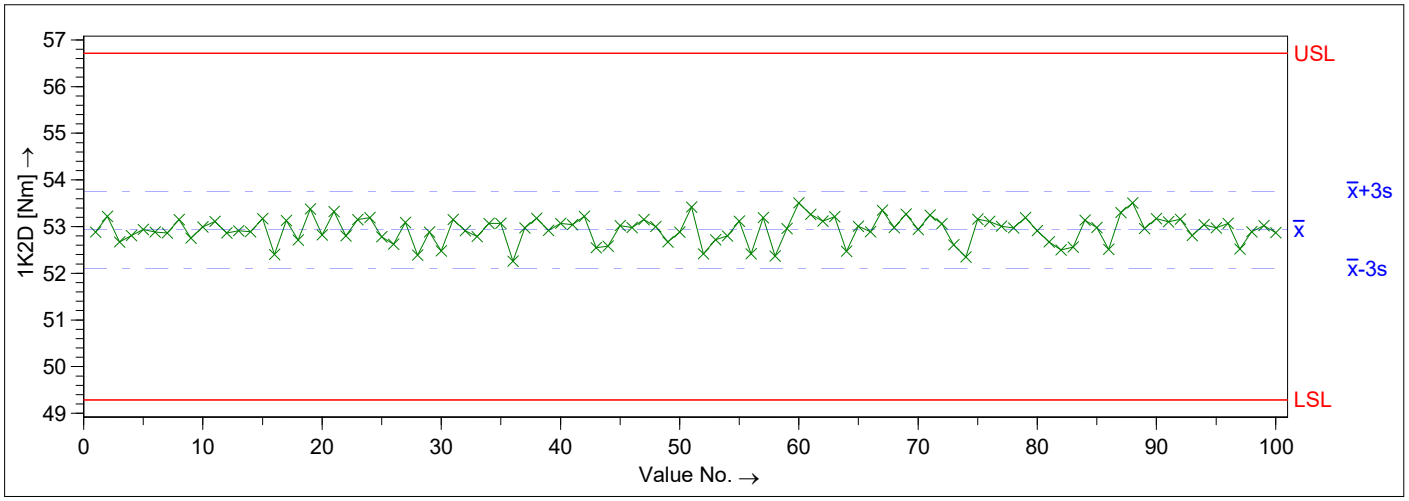
Plant ATG Westhausen		Operator Name Sünder	Date 08.02.2022

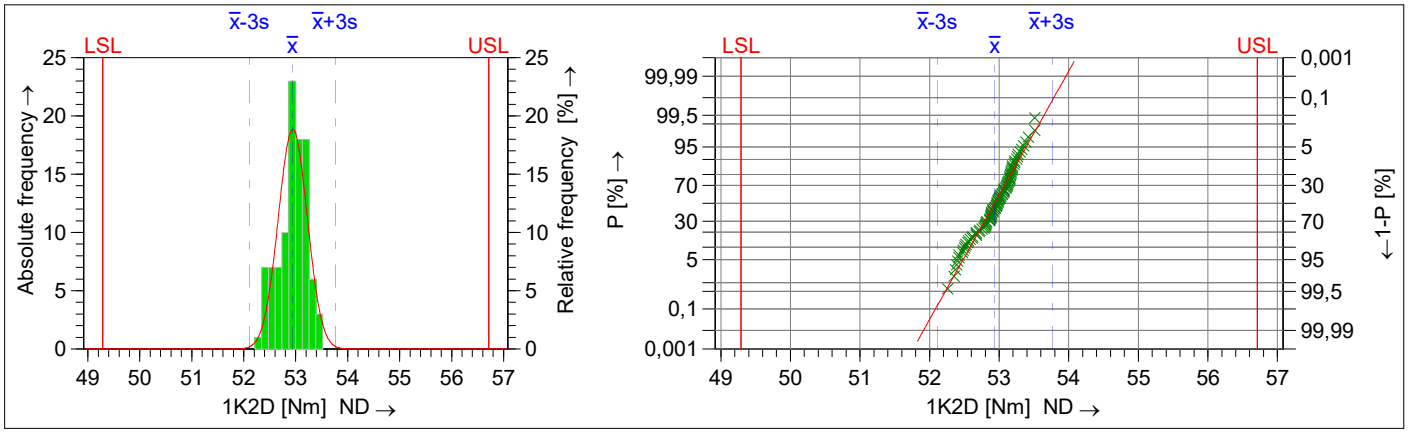
Ord. No. 1BD53T2O-A	Part type 1BD-1B060A-1K1D-1VK2D				Contr.item yes
Serial No. 756028_b	Char.Descr. 1K2D	Inspection Val.	53,00	3,71	USL 56,71
	Serial No. 202852	Unit	Nm	-3,71	LSL 49,29
Char.Type variable		Tolerance value	7 %		Decimal Pl. 2

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

Evaluation from 08.02.2022 07:18:01 to 08.02.2022 07:33:39

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			$\bar{x}$	52.9351
LSL	49.29	x_{min}	52.26	$\bar{x}$-3s	52.1099
USL	56.71	x_{max}	53.51	$\bar{x}$+3s	53.7603
T	7.42	R	1.25	6s	1.6503
		$n_{<T>}$	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	4.50
Critical capability index	=	C_{mk}	4.42

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 08.02.2022

Ser.No.	756028_b	Characteristic			
Type	1BD-1B060A-1K1D-1VK2D	Char.Descr.	1K2D	Inspection Val.	53,00
Ord. No.	1BD53T2O-A	Ser.No.	202852	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}
202852	1K2D	52,88	53,22	52,67	52,81	52,94	52,88	52,86	53,15	52,75	52,99
202852	1K2D	31,00	31,00	31,00	31,00	31,00	31,00	32,00	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}
202852	1K2D	53,11	52,86	52,91	52,89	53,17	52,40	53,13	52,71	53,38	52,82
202852	1K2D	31,00	31,00	31,00	31,00	30,00	30,00	30,00	30,00	31,00	31,00

Char.No.	Char.Descr.	x_{21}	x_{22}	x_{23}	x_{24}	x_{25}	x_{26}	x_{27}	x_{28}	x_{29}	x_{30}
202852	1K2D	53,32	52,80	53,15	53,19	52,78	52,62	53,09	52,39	52,88	52,48
202852	1K2D	31,00	31,00	31,00	31,00	31,00	30,00	31,00	30,00	30,00	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}
202852	1K2D	53,15	52,91	52,79	53,07	53,07	52,26	52,97	53,18	52,92	53,07
202852	1K2D	31,00	30,00	30,00	30,00	30,00	30,00	31,00	31,00	31,00	31,00

Char.No.	Char.Descr.	x_{41}	x_{42}	x_{43}	x_{44}	x_{45}	x_{46}	x_{47}	x_{48}	x_{49}	x_{50}
202852	1K2D	53,04	53,22	52,55	52,58	53,02	52,98	53,15	53,00	52,67	52,88
202852	1K2D	31,00	31,00	31,00	30,00	31,00	31,00	31,00	31,00	31,00	31,00

Char.No.	Char.Descr.	x_{51}	x_{52}	x_{53}	x_{54}	x_{55}	x_{56}	x_{57}	x_{58}	x_{59}	x_{60}
202852	1K2D	53,42	52,42	52,72	52,80	53,12	52,42	53,19	52,37	52,96	53,51
202852	1K2D	31,00	30,00	30,00	30,00	31,00	30,00	31,00	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}
202852	1K2D	53,26	53,12	53,21	52,47	53,01	52,89	53,35	52,98	53,27	52,94
202852	1K2D	31,00	31,00	30,00	30,00	31,00	30,00	31,00	30,00	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}
202852	1K2D	53,25	53,06	52,61	52,35	53,16	53,11	53,01	52,97	53,19	52,91
202852	1K2D	30,00	31,00	30,00	30,00	30,00	30,00	30,00	31,00	31,00	31,00

Machine Capability Study
Tool System

Plant	ATG Westhausen		Operator Name	Sünder	Date 08.02.2022

Ser.No.	756028_b	Characteristic			
Type	1BD-1B060A-1K1D-1VK2D	Char.Descr.	1K2D	Inspection Val.	53,00
Ord. No.	1BD53T2O-A	Ser.No.	202852	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}
202852	1K2D	52,67	52,50	52,56	53,14	52,98	52,51	53,30	53,51	52,96	53,17
202852	1K2D	30,00	30,00	30,00	31,00	31,00	30,00	30,00	31,00	31,00	31,00

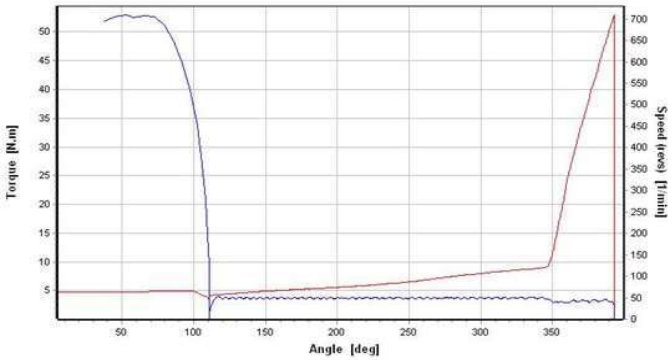
Char.No.	Char.Descr.	x_{91}	x_{92}	x_{93}	x_{94}	x_{95}	x_{96}	x_{97}	x_{98}	x_{99}	x_{100}
202852	1K2D	53,10	53,16	52,81	53,04	52,97	53,07	52,52	52,89	53,02	52,87
202852	1K2D	31,00	31,00	30,00	30,00	31,00	31,00	30,00	31,00	30,00	30,00

Torque graphs

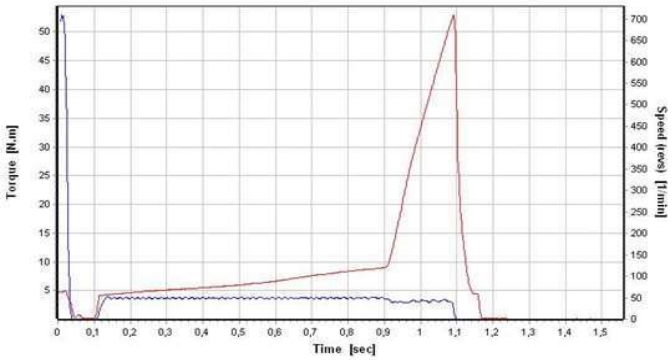
Machine Capability Study 100 %

Model: **1BD-1B060A-1K2D-1VK2D**
Serial no: **756028**

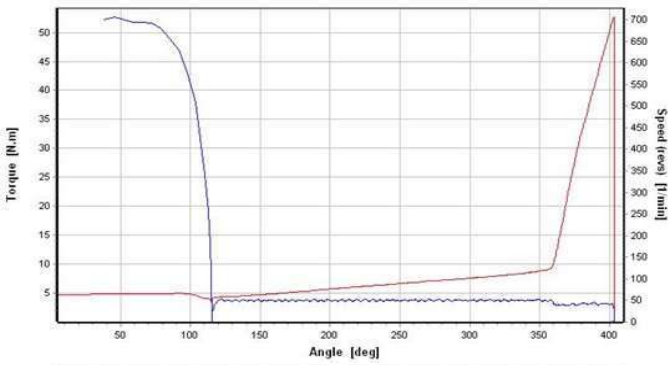
Angle degree: **30°**
Test torque: **53,0 Nm**



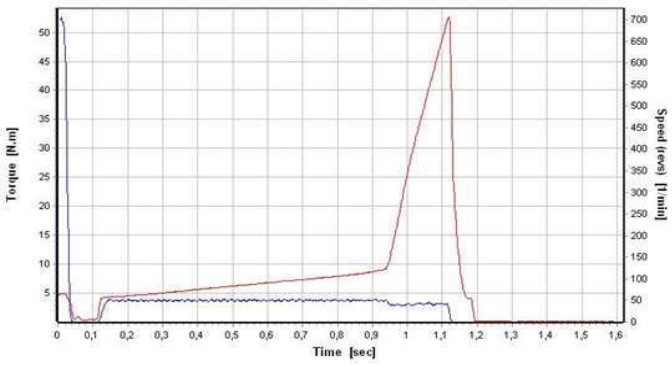
Value no. 1
Graph
Torque / Angle / Speed



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

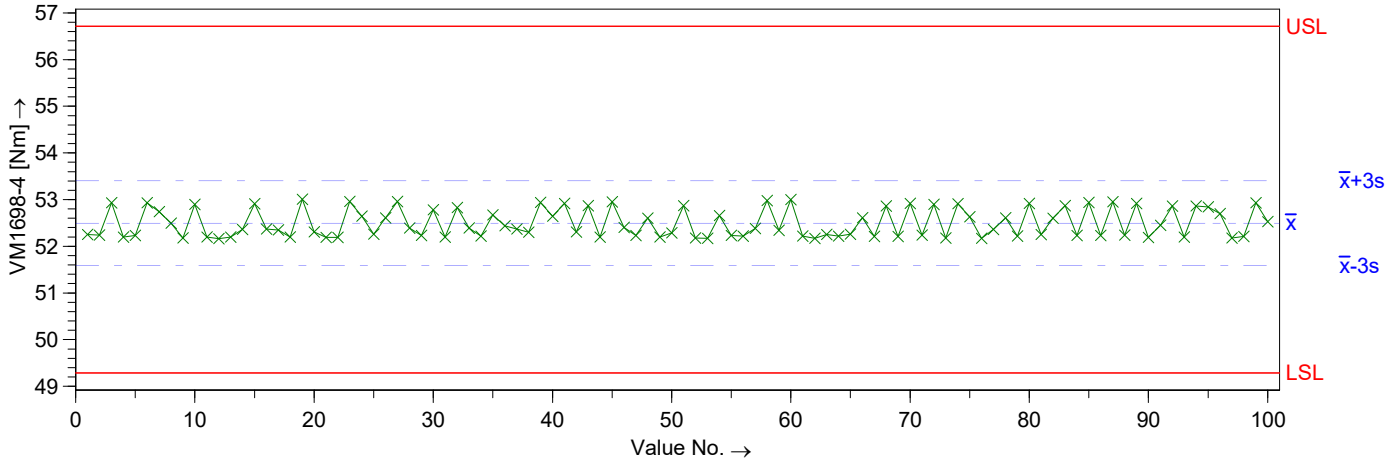
Plant	ATG Westhausen	Operator Name	Sünder
Date	07.02.2022		

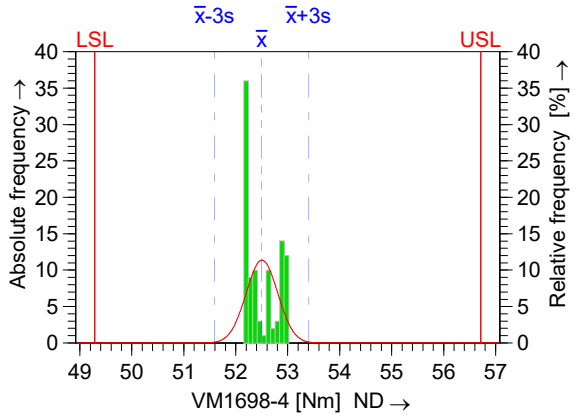
Ord. No.	1BD53T2O-A	Part type	1BD-1B060A-1K1D-1VK2D	Contr.item	yes
Serial No.	756028_a	Char.Descr.	VM1698-4	Inspection Val. 53,00 3,71	USL 56,71
		Serial No.	1024210	Unit Nm -3,71	LSL 49,29
Char.Type	variable			Tolerance value 7 %	Decimal Pl. 2

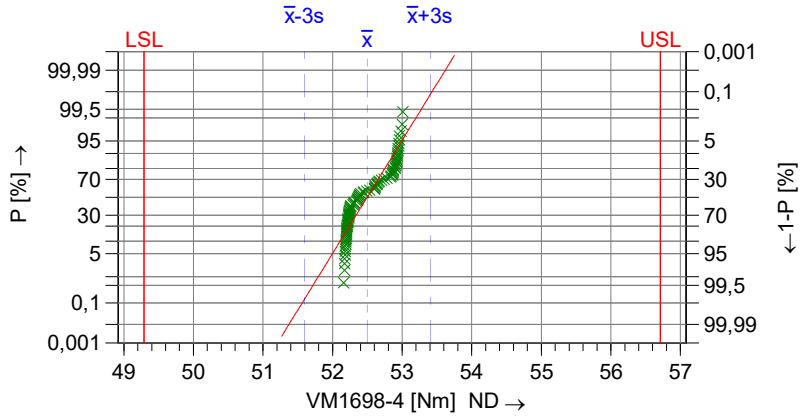
Cust.Name	Cleco	Reference System	VM1698-4	Test Electronic	MPRO400GCD-P
Contr.No.	Homologation	Reference Transducer	50 / 1024729	nges.	100

Evaluation from 07.02.2022 15:21:20 to 07.02.2022 17:10:57

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			$\bar{x}$	52.4962
LSL	49.29	x_{min}	52.16	$\bar{x}$-3s	51.5907
USL	56.71	x_{max}	53.01	$\bar{x}$+3s	53.4017
T	7.42	R	0.85	6s	1.8109
		$n_{<T>}$	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	4.10
Critical capability index	=	C_{mk}	3.54

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 07.02.2022

Ser.No.	756028_a	Characteristic			
Type	1BD-1B060A-1K1D-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	52,25	52,24	52,93	52,20	52,23	52,93	52,74	52,49	52,18	52,90
1024210	VM1698-4	370,50	361,25	360,75	358,00	358,50	365,25	362,00	359,00	352,00	372,00

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	52,20	52,16	52,20	52,36	52,91	52,37	52,35	52,20	53,01	52,31
1024210	VM1698-4	364,50	366,25	367,50	367,00	360,50	356,75	355,25	358,00	371,25	367,50

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	52,19	52,19	52,96	52,64	52,26	52,61	52,96	52,39	52,23	52,78
1024210	VM1698-4	363,00	366,50	377,50	367,50	359,75	365,50	350,25	347,50	343,75	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	52,20	52,83	52,39	52,22	52,67	52,44	52,37	52,30	52,94	52,64
1024210	VM1698-4	355,75	364,75	364,75	360,25	362,00	364,25	369,00	349,00	366,25	355,50

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	52,92	52,31	52,87	52,20	52,95	52,40	52,23	52,60	52,20	52,29
1024210	VM1698-4	364,50	355,75	364,50	356,50	369,75	365,50	361,50	356,50	353,75	346,25

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	52,87	52,18	52,17	52,66	52,23	52,22	52,38	52,98	52,34	53,00
1024210	VM1698-4	364,75	357,00	356,00	359,25	361,75	361,25	356,50	350,75	356,50	365,25

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	52,22	52,17	52,25	52,22	52,26	52,61	52,21	52,86	52,21	52,92
1024210	VM1698-4	354,50	353,00	351,00	356,25	357,50	359,25	360,00	366,50	351,75	362,75

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	52,24	52,90	52,18	52,91	52,63	52,17	52,36	52,61	52,22	52,92
1024210	VM1698-4	352,50	360,50	350,00	369,50	352,75	353,50	362,50	359,50	349,50	361,50

Machine Capability Study
Control System

Plant	ATG Westhausen		Operator Name	Sünder	Date 07.02.2022

Ser.No.	756028_a	Characteristic			
Type	1BD-1B060A-1K1D-1VK2D	Char.Descr.	VM1698-4	Inspection Val.	53,00
Ord. No.	1BD53T2O-A	Ser.No.	1024210	LSL	49,29
				USL	56,71
Remark	TQ 100% soft +/-7% * TQ-Cal.: 60.0 Nm; Cur-Cal.: 3.8391 Nm/A; Speed: 700/50 rpm;				

Char.No.	Char.Descr.	x_{81}	x_{82}	x_{83}	x_{84}	x_{85}	x_{86}	x_{87}	x_{88}	x_{89}	x_{90}
1024210	VM1698-4	52,25	52,60	52,87	52,23	52,94	52,23	52,95	52,24	52,92	52,19
1024210	VM1698-4	350,75	354,25	358,75	351,00	359,25	355,75	367,75	356,00	355,50	348,00

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	52,45	52,86	52,20	52,86	52,84	52,70	52,18	52,21	52,93	52,53
1024210	VM1698-4	348,25	354,75	355,25	364,75	363,50	364,75	356,75	359,50	361,50	352,00

Machine Capability Study
Tool System

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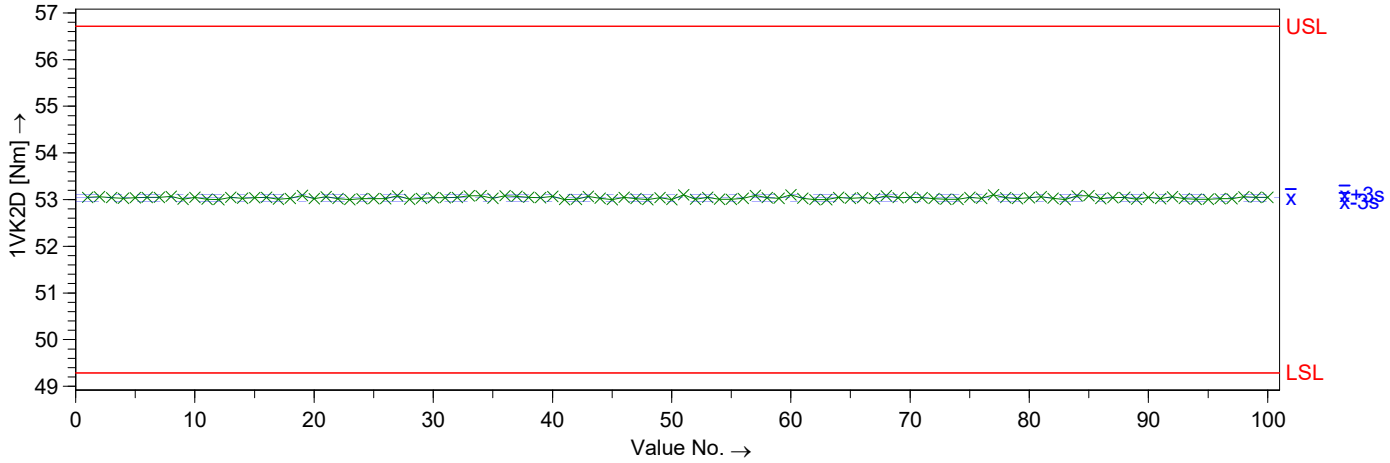
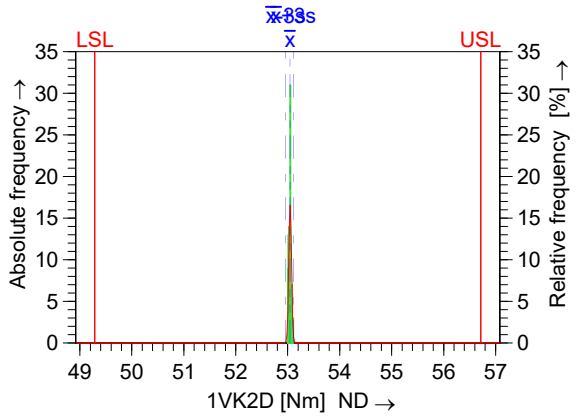
Plant	ATG Westhausen	Operator Name	Sünder
Date	07.02.2022		

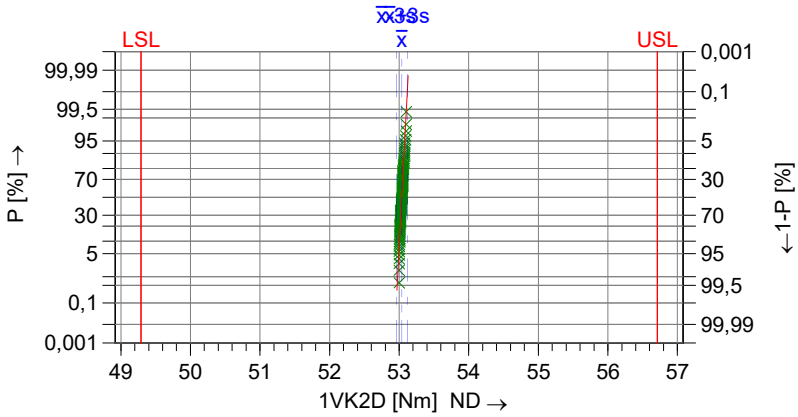
Ord. No.	1BD53T2O-A	Part type	1BD-1B060A-1K1D-1VK2D	Contr.item	yes
Serial No.	756028_a	Char.Descr.	1VK2D	Inspection Val. 53,00 3,71	USL 56,71
		Serial No.	200693_1	Unit Nm -3,71	LSL 49,29
Char.Type	variable			Tolerance value 7 %	Decimal Pl. 2
Cust.Name	Cleco	Reference System	VM1698-4	Test Electronic	MPRO400GCD-P
Contr.No.	Homologation	Reference Transducer	50 / 1024729	nges.	100

Evaluation from 07.02.2022 15:21:21 to 07.02.2022 17:10:58

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			$\bar{x}$	53.0380
LSL	49.29	x_{min}	53.00	$\bar{x}$-3s	52.9601
USL	56.71	x_{max}	53.10	$\bar{x}$+3s	53.1159
T	7.42	R	0.10	6s	0.1559
		$n_{<T>}$	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	47.61
Critical capability index	=	C_{mk}	47.12

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

APEX VDI/VDE 2647 V0.1

Apex Tool Group GmbH \\htwe0006\AppData\QW\QWE\MessWert\2022\756028_a1.DFD

Machine Capability Study
Tool System

Plant	ATG Westhausen		Operator Name	Sünder	Date 07.02.2022

Ser.No.	756028_a	Characteristic			
Type	1BD-1B060A-1K1D-1VK2D	Char.Descr.	1VK2D	Inspection Val.	53,00
Ord. No.	1BD53T2O-A	Ser.No.	200693_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}
200693_	1VK2D	53,05	53,06	53,04	53,03	53,04	53,05	53,05	53,07	53,01	53,05
200693_	1VK2D	376,00	366,00	362,00	363,00	363,00	366,00	365,00	362,00	357,00	373,00

Char.No.	Char.Descr.	x_{11}	x_{12}	x_{13}	x_{14}	x_{15}	x_{16}	x_{17}	x_{18}	x_{19}	x_{20}
200693_	1VK2D	53,01	53,00	53,05	53,03	53,04	53,05	53,01	53,03	53,09	53,02
200693_	1VK2D	369,00	373,00	373,00	373,00	361,00	362,00	359,00	363,00	372,00	374,00

Char.No.	Char.Descr.	x_{21}	x_{22}	x_{23}	x_{24}	x_{25}	x_{26}	x_{27}	x_{28}	x_{29}	x_{30}
200693_	1VK2D	53,06	53,02	53,00	53,02	53,02	53,02	53,08	53,01	53,03	53,04
200693_	1VK2D	368,00	373,00	378,00	370,00	365,00	369,00	350,00	351,00	349,00	367,00

Char.No.	Char.Descr.	x_{31}	x_{32}	x_{33}	x_{34}	x_{35}	x_{36}	x_{37}	x_{38}	x_{39}	x_{40}
200693_	1VK2D	53,04	53,05	53,08	53,08	53,03	53,08	53,07	53,05	53,04	53,07
200693_	1VK2D	361,00	366,00	371,00	366,00	364,00	369,00	374,00	354,00	366,00	358,00

Char.No.	Char.Descr.	x_{41}	x_{42}	x_{43}	x_{44}	x_{45}	x_{46}	x_{47}	x_{48}	x_{49}	x_{50}
200693_	1VK2D	53,00	53,01	53,07	53,03	53,00	53,05	53,02	53,00	53,04	53,00
200693_	1VK2D	365,00	360,00	365,00	362,00	370,00	371,00	367,00	360,00	359,00	351,00

Char.No.	Char.Descr.	x_{51}	x_{52}	x_{53}	x_{54}	x_{55}	x_{56}	x_{57}	x_{58}	x_{59}	x_{60}
200693_	1VK2D	53,10	53,01	53,05	53,01	53,01	53,03	53,09	53,04	53,03	53,10
200693_	1VK2D	366,00	362,00	362,00	362,00	367,00	366,00	361,00	351,00	361,00	366,00

Char.No.	Char.Descr.	x_{61}	x_{62}	x_{63}	x_{64}	x_{65}	x_{66}	x_{67}	x_{68}	x_{69}	x_{70}
200693_	1VK2D	53,03	53,00	53,00	53,05	53,03	53,04	53,02	53,08	53,04	53,05
200693_	1VK2D	360,00	358,00	359,00	361,00	362,00	362,00	365,00	369,00	357,00	363,00

Char.No.	Char.Descr.	x_{71}	x_{72}	x_{73}	x_{74}	x_{75}	x_{76}	x_{77}	x_{78}	x_{79}	x_{80}
200693_	1VK2D	53,04	53,02	53,01	53,01	53,05	53,03	53,10	53,04	53,02	53,04
200693_	1VK2D	358,00	361,00	356,00	370,00	356,00	358,00	367,00	363,00	354,00	362,00

Machine Capability Study
Tool System

Plant	ATG Westhausen		Operator Name	Sünder	Date 07.02.2022

Ser.No.	756028_a	Characteristic			
Type	1BD-1B060A-1K1D-1VK2D	Char.Descr.	1VK2D	Inspection Val.	53,00
Ord. No.	1BD53T2O-A	Ser.No.	200693_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}
200693_	1VK2D	53,06	53,03	53,00	53,08	53,08	53,02	53,04	53,05	53,01	53,05
200693_	1VK2D	357,00	356,00	360,00	356,00	360,00	361,00	368,00	362,00	356,00	354,00

Char.No.	Char.Descr.	x_{91}	x_{92}	x_{93}	x_{94}	x_{95}	x_{96}	x_{97}	x_{98}	x_{99}	x_{100}
200693_	1VK2D	53,02	53,06	53,02	53,01	53,01	53,02	53,02	53,06	53,05	53,05
200693_	1VK2D	350,00	357,00	361,00	365,00	365,00	367,00	365,00	365,00	362,00	356,00

Machine Capability Study
Tool System

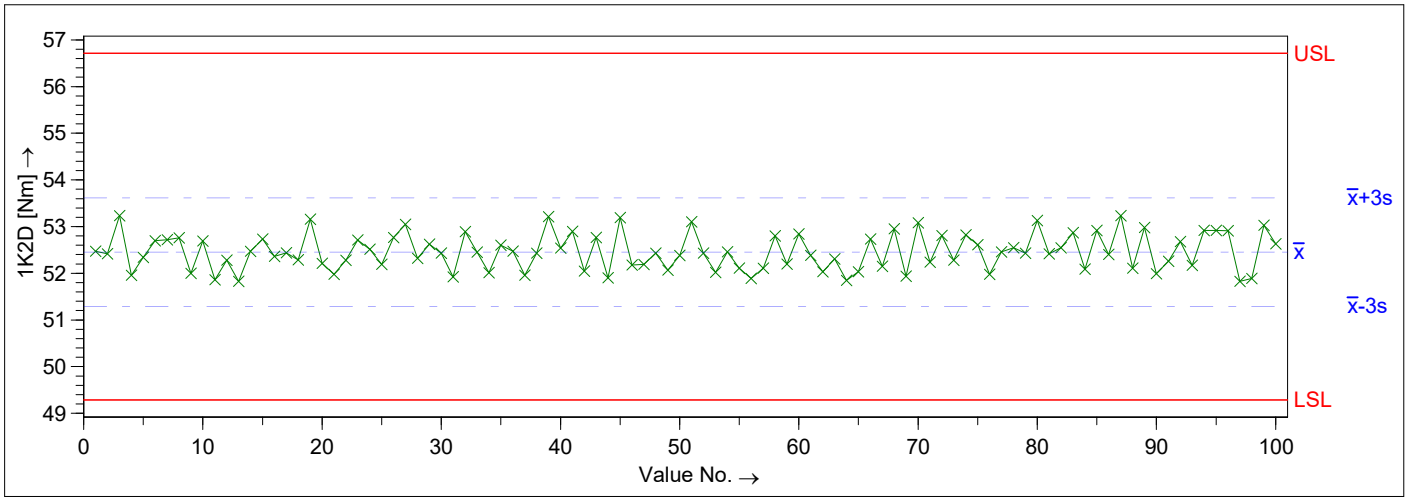
Plant ATG Westhausen		Operator Name Sünder	Date 07.02.2022

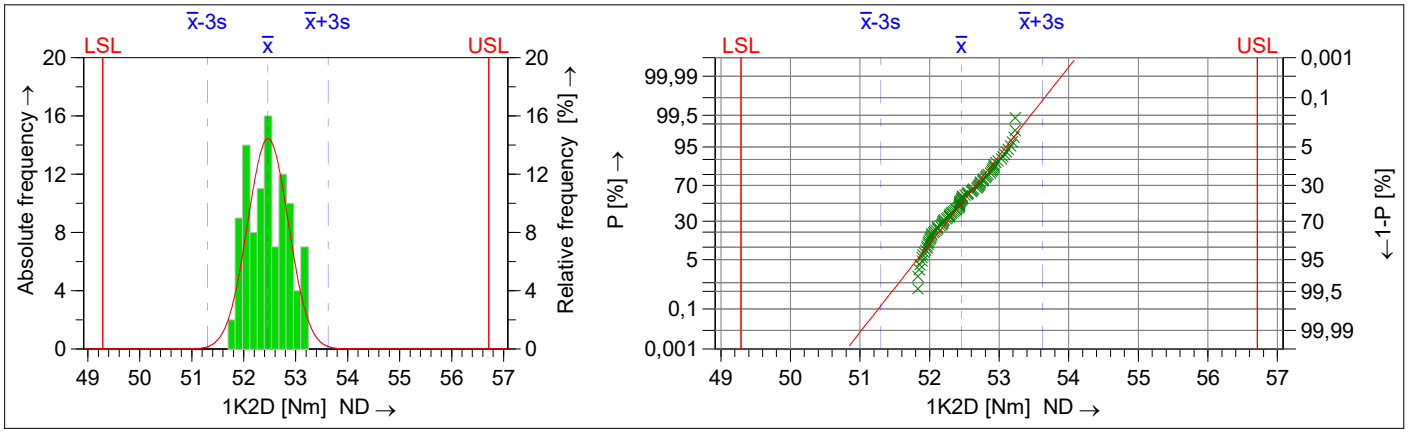
Ord. No. 1BD53T2O-A	Part type 1BD-1B060A-1K1D-1VK2D				Contr.item yes
Serial No. 756028_a	Char.Descr. 1K2D	Inspection Val.	53,00	3,71	USL 56,71
	Serial No. 202852	Unit	Nm	-3,71	LSL 49,29
Char.Type variable		Tolerance value	7 %		Decimal Pl. 2

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

Evaluation from 07.02.2022 15:21:21 to 07.02.2022 17:10:58

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			x̄	52.4584
LSL	49.29	x_{min}	51.83	x̄-3s	51.2982
USL	56.71	x_{max}	53.23	x̄+3s	53.6186
T	7.42	R	1.40	6s	2.3205
		$n_{<T>}$	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	3.20
Critical capability index	=	C_{mk}	2.73

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 07.02.2022

Ser.No.	756028_a	Characteristic			
Type	1BD-1B060A-1K1D-1VK2D	Char.Descr.	1K2D	Inspection Val.	53,00
Ord. No.	1BD53T2O-A	Ser.No.	202852	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}
202852	1K2D	52,47	52,42	53,23	51,96	52,34	52,70	52,72	52,76	52,00	52,69
202852	1K2D	376,00	366,00	362,00	363,00	363,00	366,00	365,00	362,00	357,00	373,00

Char.No.	Char.Descr.	x_{11}	x_{12}	x_{13}	x_{14}	x_{15}	x_{16}	x_{17}	x_{18}	x_{19}	x_{20}
202852	1K2D	51,86	52,28	51,83	52,47	52,73	52,36	52,44	52,29	53,16	52,21
202852	1K2D	369,00	373,00	373,00	373,00	361,00	362,00	359,00	363,00	372,00	374,00

Char.No.	Char.Descr.	x_{21}	x_{22}	x_{23}	x_{24}	x_{25}	x_{26}	x_{27}	x_{28}	x_{29}	x_{30}
202852	1K2D	51,98	52,28	52,71	52,51	52,19	52,77	53,05	52,32	52,62	52,43
202852	1K2D	368,00	373,00	378,00	370,00	365,00	369,00	350,00	351,00	349,00	367,00

Char.No.	Char.Descr.	x_{31}	x_{32}	x_{33}	x_{34}	x_{35}	x_{36}	x_{37}	x_{38}	x_{39}	x_{40}
202852	1K2D	51,92	52,89	52,45	52,01	52,60	52,47	51,96	52,43	53,21	52,54
202852	1K2D	361,00	366,00	371,00	366,00	364,00	369,00	374,00	354,00	366,00	358,00

Char.No.	Char.Descr.	x_{41}	x_{42}	x_{43}	x_{44}	x_{45}	x_{46}	x_{47}	x_{48}	x_{49}	x_{50}
202852	1K2D	52,90	52,05	52,77	51,90	53,19	52,18	52,19	52,43	52,07	52,38
202852	1K2D	365,00	360,00	365,00	362,00	370,00	371,00	367,00	360,00	359,00	351,00

Char.No.	Char.Descr.	x_{51}	x_{52}	x_{53}	x_{54}	x_{55}	x_{56}	x_{57}	x_{58}	x_{59}	x_{60}
202852	1K2D	53,10	52,43	52,02	52,46	52,11	51,89	52,11	52,80	52,20	52,84
202852	1K2D	366,00	362,00	362,00	362,00	367,00	366,00	361,00	351,00	361,00	366,00

Char.No.	Char.Descr.	x_{61}	x_{62}	x_{63}	x_{64}	x_{65}	x_{66}	x_{67}	x_{68}	x_{69}	x_{70}
202852	1K2D	52,38	52,03	52,31	51,85	52,03	52,73	52,15	52,95	51,94	53,08
202852	1K2D	360,00	358,00	359,00	361,00	362,00	362,00	365,00	369,00	357,00	363,00

Char.No.	Char.Descr.	x_{71}	x_{72}	x_{73}	x_{74}	x_{75}	x_{76}	x_{77}	x_{78}	x_{79}	x_{80}
202852	1K2D	52,24	52,81	52,28	52,82	52,61	51,98	52,46	52,55	52,43	53,13
202852	1K2D	358,00	361,00	356,00	370,00	356,00	358,00	367,00	363,00	354,00	362,00

Machine Capability Study
Tool System

Plant	ATG Westhausen		Operator Name	Sünder	Date 07.02.2022

Ser.No.	756028_a	Characteristic			
Type	1BD-1B060A-1K1D-1VK2D	Char.Descr.	1K2D	Inspection Val.	53,00
Ord. No.	1BD53T2O-A	Ser.No.	202852	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}
202852	1K2D	52,42	52,55	52,87	52,09	52,92	52,40	53,23	52,11	52,98	51,99
202852	1K2D	357,00	356,00	360,00	356,00	360,00	361,00	368,00	362,00	356,00	354,00

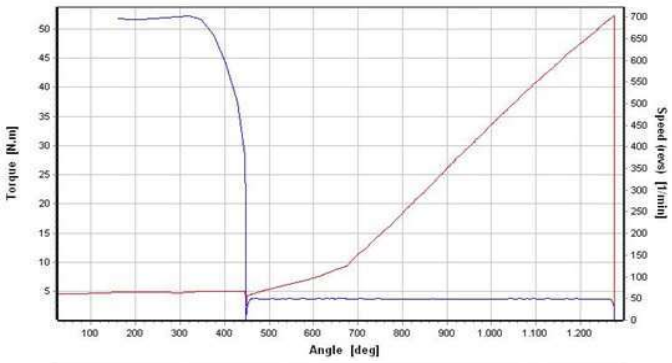
Char.No.	Char.Descr.	x_{91}	x_{92}	x_{93}	x_{94}	x_{95}	x_{96}	x_{97}	x_{98}	x_{99}	x_{100}
202852	1K2D	52,26	52,68	52,17	52,92	52,92	52,91	51,83	51,89	53,03	52,63
202852	1K2D	350,00	357,00	361,00	365,00	365,00	367,00	365,00	365,00	362,00	356,00

Torque graphs

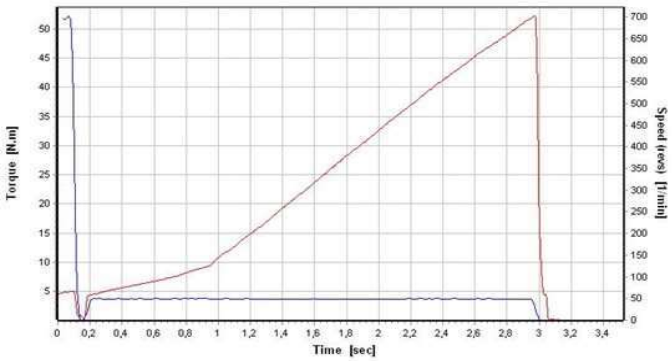
Machine Capability Study 100 %

Model: **1BD-1B060A-1K2D-1VK2D**
Serial no: **756028**

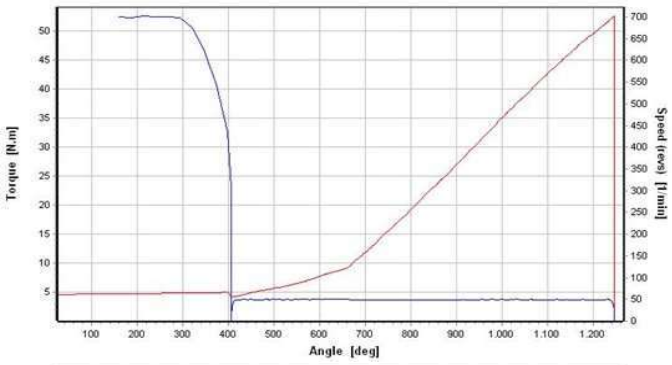
Angle degree: **360°**
Test torque: **53,0 Nm**



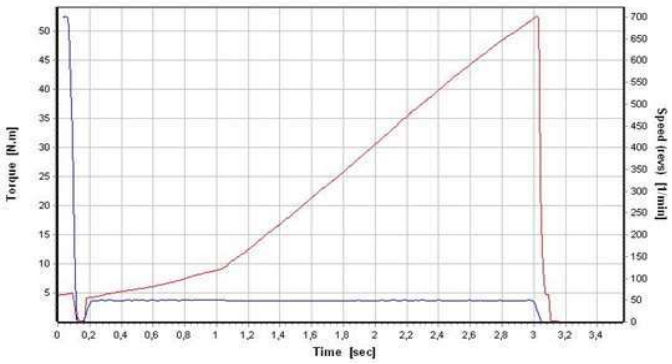
Value no. 1
Graph
Torque / Angle / Speed



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:** 756028

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: 4,13 % ± **2,06 %**

Angle degree: 40° Tolerance: 4,1° ± **2,0°**

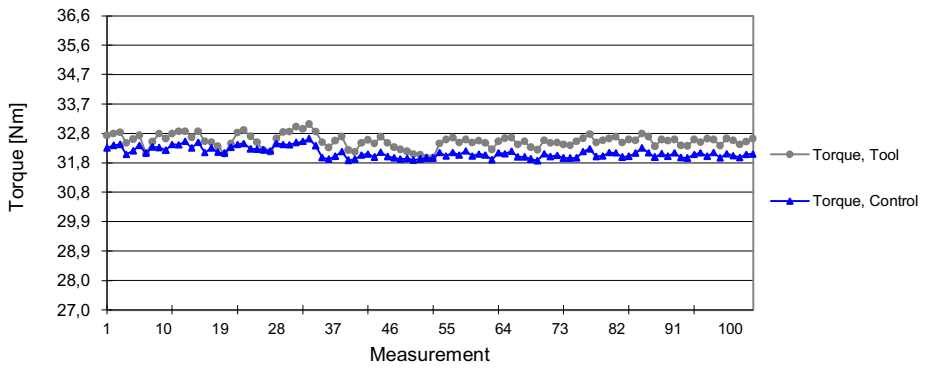
Formula derivation: $C_m = \frac{T}{6\,s}$ $T = C_m * 6\,s$

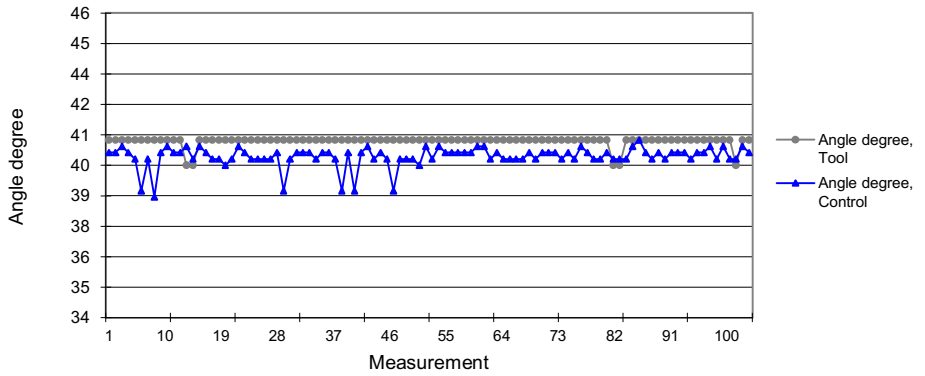
Tool without angle correction

Measurement	Tool data		Control data		Difference	
No.	Torque	Angle	Torque	Angle	Torque	Angle
1	32,68	41,00	32,28	40,50	0,40	0,50
2	32,74	41,00	32,37	40,50	0,37	0,50
3	32,79	41,00	32,40	40,75	0,39	0,25
4	32,44	41,00	32,07	40,50	0,37	0,50
5	32,57	41,00	32,19	40,25	0,38	0,75
6	32,69	41,00	32,36	39,00	0,33	2,00
7	32,10	41,00	32,11	40,25	0,01	0,75
8	32,48	41,00	32,31	38,75	0,17	2,25
9	32,74	41,00	32,29	40,50	0,45	0,50
10	32,59	41,00	32,21	40,75	0,38	0,25
11	32,74	41,00	32,39	40,50	0,35	0,50
12	32,82	41,00	32,38	40,50	0,44	0,50
13	32,82	40,00	32,49	40,75	0,33	0,75
14	32,63	40,00	32,28	40,25	0,35	0,25
15	32,82	41,00	32,47	40,75	0,35	0,25
16	32,50	41,00	32,13	40,50	0,37	0,50
17	32,47	41,00	32,28	40,25	0,19	0,75
18	32,33	41,00	32,14	40,25	0,19	0,75
19	32,09	41,00	32,11	40,00	0,02	1,00
20	32,42	41,00	32,30	40,25	0,12	0,75
21	32,78	41,00	32,39	40,75	0,39	0,25
22	32,86	41,00	32,42	40,50	0,44	0,50
23	32,66	41,00	32,25	40,25	0,41	0,75
24	32,47	41,00	32,24	40,25	0,23	0,75
25	32,21	41,00	32,22	40,25	0,01	0,75
26	32,15	41,00	32,18	40,25	0,03	0,75
27	32,59	41,00	32,42	40,50	0,17	0,50
28	32,80	41,00	32,39	39,00	0,41	2,00
29	32,81	41,00	32,38	40,25	0,43	0,75
30	32,97	41,00	32,46	40,50	0,51	0,50
31	32,90	41,00	32,49	40,50	0,41	0,50
32	33,05	41,00	32,58	40,50	0,47	0,50
33	32,81	41,00	32,35	40,25	0,46	0,75
34	32,47	41,00	31,97	40,50	0,50	0,50
35	32,29	41,00	31,91	40,50	0,38	0,50
36	32,51	41,00	32,01	40,25	0,50	0,75
37	32,65	41,00	32,16	39,00	0,49	2,00
38	32,21	41,00	31,88	40,50	0,33	0,50
39	32,15	41,00	31,91	39,00	0,24	2,00
40	32,44	41,00	32,05	40,50	0,39	0,50
41	32,54	41,00	32,08	40,75	0,46	0,25
42	32,43	41,00	31,98	40,25	0,45	0,75
43	32,64	41,00	32,14	40,50	0,50	0,50
44	32,44	41,00	32,00	40,25	0,44	0,75
45	32,30	41,00	31,96	39,00	0,34	2,00
46	32,23	41,00	31,91	40,25	0,32	0,75
47	32,17	41,00	31,94	40,25	0,23	0,75
48	32,08	41,00	31,89	40,25	0,19	0,75
49	32,06	41,00	31,92	40,00	0,14	1,00
50	31,96	41,00	31,95	40,75	0,01	0,25
51	31,96	41,00	31,95	40,25	0,01	0,75
52	32,43	41,00	32,13	40,75	0,30	0,25
53	32,55	41,00	32,02	40,50	0,53	0,50
54	32,61	41,00	32,13	40,50	0,48	0,50
55	32,46	41,00	32,05	40,50	0,41	0,50
56	32,55	41,00	32,18	40,50	0,37	0,50
57	32,46	41,00	32,02	40,50	0,44	0,50
58	32,51	41,00	32,08	40,75	0,43	0,25
59	32,44	41,00	32,05	40,75	0,39	0,25
60	32,23	41,00	31,90	40,25	0,33	0,75
61	32,49	41,00	32,12	40,50	0,37	0,50
62	32,60	41,00	32,09	40,25	0,51	0,75
63	32,62	41,00	32,17	40,25	0,45	0,75
64	32,40	41,00	31,99	40,25	0,41	0,75
65	32,49	41,00	31,99	40,25	0,50	0,75
66	32,30	41,00	31,92	40,50	0,38	0,50
67	32,22	41,00	31,87	40,25	0,35	0,75
68	32,52	41,00	32,09	40,50	0,43	0,50
69	32,44	41,00	32,00	40,50	0,44	0,50
70	32,45	41,00	32,04	40,50	0,41	0,50
71	32,40	41,00	31,95	40,25	0,45	0,75
72	32,37	41,00	31,95	40,50	0,42	0,50
73	32,50	41,00	31,96	40,25	0,54	0,75
74	32,60	41,00	32,16	40,75	0,44	0,25
75	32,73	41,00	32,25	40,50	0,48	0,50
76	32,46	41,00	32,00	40,25	0,46	0,75
77	32,53	41,00	32,02	40,25	0,51	0,75
78	32,59	41,00	32,13	40,50	0,46	0,50
79	32,64	40,00	32,12	40,25	0,52	0,25
80	32,46	40,00	31,98	40,25	0,48	0,25
81	32,56	41,00	32,01	40,25	0,55	0,75
82	32,52	41,00	32,11	40,75	0,41	0,25
83	32,74	41,00	32,28	41,00	0,46	0,00
84	32,65	41,00	32,12	40,50	0,53	0,50
85	32,33	41,00	31,98	40,25	0,35	0,75
86	32,55	41,00	32,10	40,50	0,45	0,50
87	32,51	41,00	32,01	40,25	0,50	0,75
88	32,56	41,00	32,12	40,50	0,44	0,50
89	32,36	41,00	31,97	40,50	0,39	0,50
90	32,34	41,00	31,95	40,50	0,39	0,50
91	32,56	41,00	32,07	40,25	0,49	0,75
92	32,47	41,00	32,12	40,50	0,35	0,50
93	32,58	41,00	32,01	40,50	0,57	0,50
94	32,55	41,00	32,13	40,75	0,42	0,25
95	32,35	41,00	31,96	40,25	0,39	0,75
96	32,59	41,00	32,09	40,75	0,50	0,25
97	32,52	41,00	32,03	40,25	0,49	0,75
98	32,39	40,00	31,97	40,25	0,42	0,25
99	32,48	41,00	32,07	40,75	0,41	0,25
100	32,58	41,00	32,08	40,50	0,50	0,50
				Standard deviation:	**0,131**	**0,407**

Graphical representation

Model:	**1BD-1B060A-1K2D-1VK2D**	Serial no:	**756028**
Target torque:	**31,80 Nm**	60 % of max. torque	
Angle degree:	**40°**	Tool without angle correction	





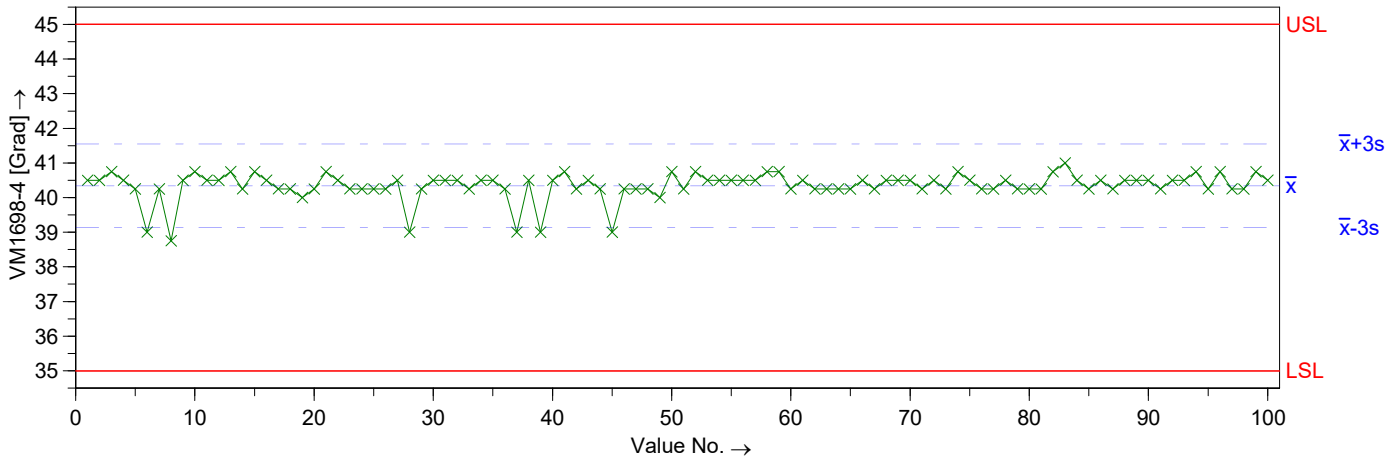
Machine Capability Study
Control System

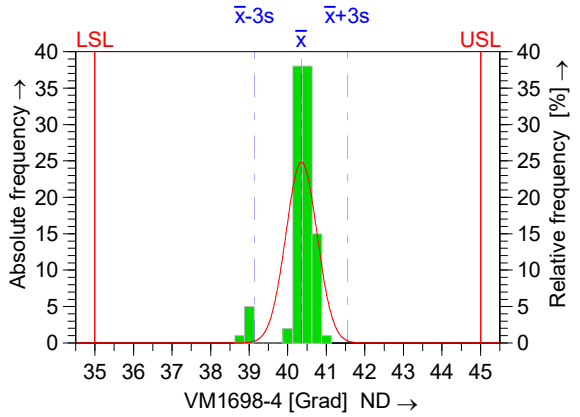
Plant	ATG Westhausen	Operator Name	Sünder
Date	08.02.2022		

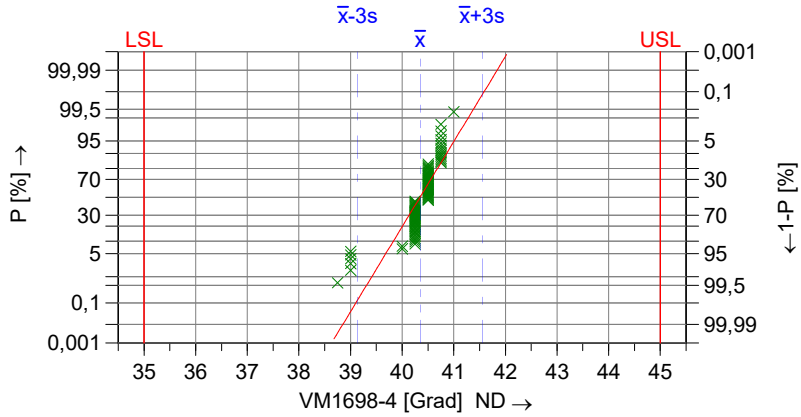
Ord. No.	1BD53T2O-A	Part type	1BD-1B060A-1K1D-1VK2D	Contr.item	yes
Serial No.	756028_k	Char.Descr.	VM1698-4	Inspection Val. 40,00 5,00	USL 45,00
		Serial No.	1024210	Unit Grad -5,00	LSL 35,00
Char.Type	variable			Tolerance value 12 %	Decimal Pl. 2
Cust.Name	Cleco	Reference System	VM1698-4	Test Electronic	MPRO400GCD-P
Contr.No.	Homologation	Reference Transducer	50 / 1024729	nges.	100

Evaluation from 08.02.2022 11:05:52 to 08.02.2022 11:20:00

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			$\bar{x}$	40.3450
LSL	35.00	x_{min}	38.75	$\bar{x}$-3s	39.1400
USL	45.00	x_{max}	41.00	$\bar{x}$+3s	41.5500
T	10.00	R	2.25	6s	2.4100
		$n_{<T>}$	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	4.15
Critical capability index	=	C_{mk}	3.86

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 08.02.2022

Ser.No.	756028_k	Characteristic			
Type	1BD-1B060A-1K1D-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	32,28	32,37	32,40	32,07	32,19	32,36	32,11	32,31	32,29	32,21
1024210	VM1698-4	40,50	40,50	40,75	40,50	40,25	39,00	40,25	38,75	40,50	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	32,39	32,38	32,49	32,28	32,47	32,13	32,28	32,14	32,11	32,30
1024210	VM1698-4	40,50	40,50	40,75	40,25	40,75	40,50	40,25	40,25	40,00	40,25

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	32,39	32,42	32,25	32,24	32,22	32,18	32,42	32,39	32,38	32,46
1024210	VM1698-4	40,75	40,50	40,25	40,25	40,25	40,25	40,50	39,00	40,25	40,50

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	32,49	32,58	32,35	31,97	31,91	32,01	32,16	31,88	31,91	32,05
1024210	VM1698-4	40,50	40,50	40,25	40,50	40,50	40,25	39,00	40,50	39,00	40,50

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	32,08	31,98	32,14	32,00	31,96	31,91	31,94	31,89	31,92	31,95
1024210	VM1698-4	40,75	40,25	40,50	40,25	39,00	40,25	40,25	40,25	40,00	40,75

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	31,95	32,13	32,02	32,13	32,05	32,18	32,02	32,08	32,05	31,90
1024210	VM1698-4	40,25	40,75	40,50	40,50	40,50	40,50	40,50	40,75	40,75	40,25

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	32,12	32,09	32,17	31,99	31,99	31,92	31,87	32,09	32,00	32,04
1024210	VM1698-4	40,50	40,25	40,25	40,25	40,25	40,50	40,25	40,50	40,50	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	31,95	31,95	31,96	32,16	32,25	32,00	32,02	32,13	32,12	31,98
1024210	VM1698-4	40,25	40,50	40,25	40,75	40,50	40,25	40,25	40,50	40,25	40,25

Machine Capability Study
Control System

Plant	ATG Westhausen		Operator Name	Sünder	Date 08.02.2022

Ser.No.	756028_k	Characteristic			
Type	1BD-1B060A-1K1D-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	32,01	32,11	32,28	32,12	31,98	32,10	32,01	32,12	31,97	31,95
1024210	VM1698-4	40,25	40,75	41,00	40,50	40,25	40,50	40,25	40,50	40,50	40,50

Char.No.	Char.Descr.	x_{91}	x_{92}	x_{93}	x_{94}	x_{95}	x_{96}	x_{97}	x_{98}	x_{99}	x_{100}
1024210	VM1698-4	32,07	32,12	32,01	32,13	31,96	32,09	32,03	31,97	32,07	32,08
1024210	VM1698-4	40,25	40,50	40,50	40,75	40,25	40,75	40,25	40,25	40,75	40,50

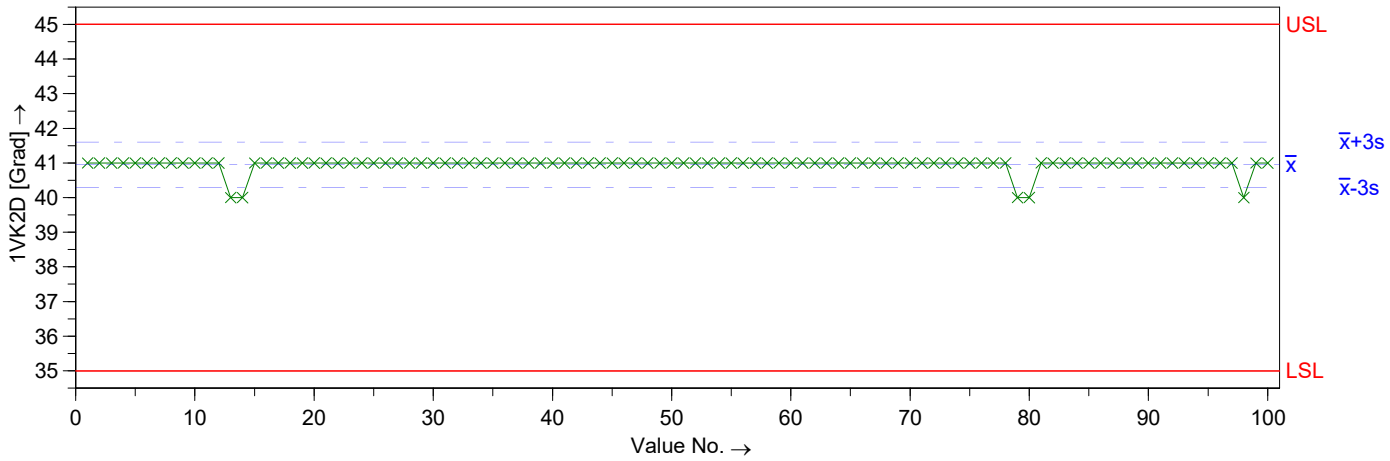
Machine Capability Study
Tool System

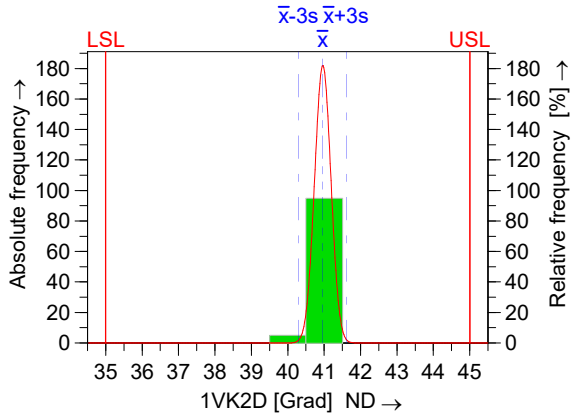
Plant	ATG Westhausen	Operator Name	Sünder
Date	08.02.2022		

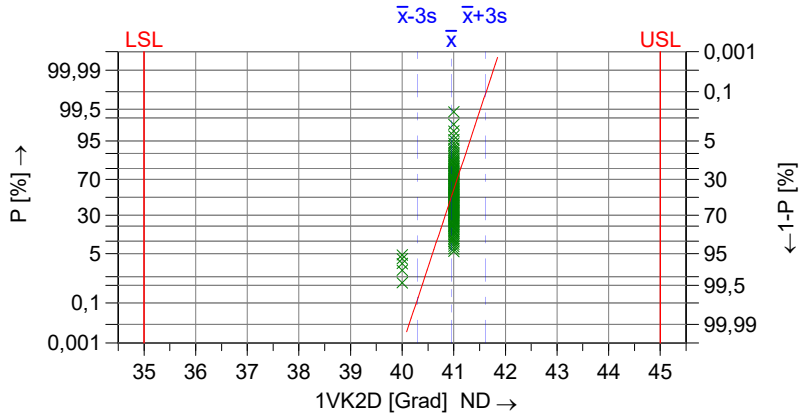
Ord. No.	1BD53T2O-A	Part type	1BD-1B060A-1K1D-1VK2D	Contr.item	yes
Serial No.	756028_k	Char.Descr.	1VK2D	Inspection Val. 40,00 5,00	USL 45,00
		Serial No.	200693_1	Unit Grad -5,00	LSL 35,00
Char.Type	variable			Tolerance value 12 %	Decimal Pl. 2
Cust.Name	Cleco	Reference System	VM1698-4	Test Electronic	MPRO400GCD-P
Contr.No.	Homologation	Reference Transducer	50 / 1024729	nges.	100

Evaluation from 08.02.2022 11:05:52 to 08.02.2022 11:20:00

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			$\bar{x}$	40.9500
LSL	35.00	x_{min}	40.00	$\bar{x}$-3s	40.2929
USL	45.00	x_{max}	41.00	$\bar{x}$+3s	41.6071
T	10.00	R	1.00	6s	1.3143
		$n_{<T>}$	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	7.61
Critical capability index	=	C_{mk}	6.16

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

APEX VDI/VDE 2647 V0.1

Machine Capability Study
Tool System

Plant	ATG Westhausen		Operator Name	Sünder	Date 08.02.2022

Ser.No.	756028_k	Characteristic			
Type	1BD-1B060A-1K1D-1VK2D	Char.Descr.	1VK2D	Inspection Val.	31,80
Ord. No.	1BD53T2O-A	Ser.No.	200693_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}
200693_	1VK2D	32,68	32,74	32,79	32,44	32,57	32,69	32,10	32,48	32,74	32,59
200693_	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}
200693_	1VK2D	32,74	32,82	32,82	32,63	32,82	32,50	32,47	32,33	32,09	32,42
200693_	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_{21}	x_{22}	x_{23}	x_{24}	x_{25}	x_{26}	x_{27}	x_{28}	x_{29}	x_{30}
200693_	1VK2D	32,78	32,86	32,66	32,47	32,21	32,15	32,59	32,80	32,81	32,97
200693_	1VK2D	41,00	41,00	41,00	41,00	41,00	41,00	41,00	41,00	41,00	41,00

Char.No.	Char.Descr.	x_{31}	x_{32}	x_{33}	x_{34}	x_{35}	x_{36}	x_{37}	x_{38}	x_{39}	x_{40}
200693_	1VK2D	32,90	33,05	32,81	32,47	32,29	32,51	32,65	32,21	32,15	32,44
200693_	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}
200693_	1VK2D	32,54	32,43	32,64	32,44	32,30	32,23	32,17	32,08	32,06	31,96
200693_	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}
200693_	1VK2D	31,96	32,43	32,55	32,61	32,46	32,55	32,46	32,51	32,44	32,23
200693_	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}
200693_	1VK2D	32,49	32,60	32,62	32,40	32,49	32,30	32,22	32,52	32,44	32,45
200693_	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}
200693_	1VK2D	32,40	32,37	32,50	32,60	32,73	32,46	32,53	32,59	32,64	32,46
200693_	1VK2D	41,00	41,00	41,00	41,00	41,00	41,00	41,00	41,00	40,00	40,00

Machine Capability Study
Tool System

Plant	ATG Westhausen		Operator Name	Sünder	Date 08.02.2022

Ser.No.	756028_k	Characteristic			
Type	1BD-1B060A-1K1D-1VK2D	Char.Descr.	1VK2D	Inspection Val.	31,80
Ord. No.	1BD53T2O-A	Ser.No.	200693_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}
200693_	1VK2D	32,56	32,52	32,74	32,65	32,33	32,55	32,51	32,56	32,36	32,34
200693_	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}
200693_	1VK2D	32,56	32,47	32,58	32,55	32,35	32,59	32,52	32,39	32,48	32,58
200693_	1VK2D	41,00	41,00	41,00	41,00	41,00	41,00	41,00	40,00	41,00	41,00

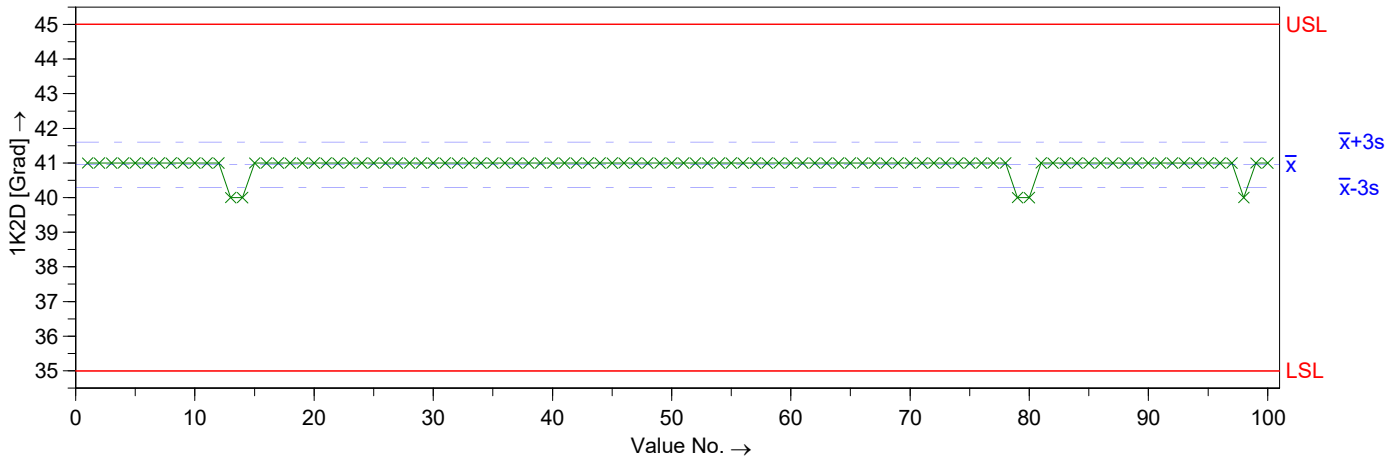
Machine Capability Study
Tool System

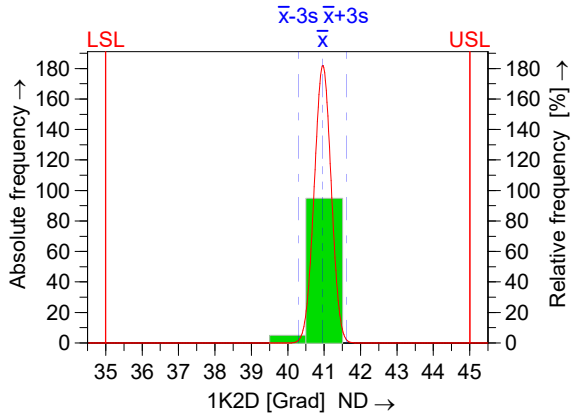
Plant	ATG Westhausen	Operator Name	Sünder
Date	08.02.2022		

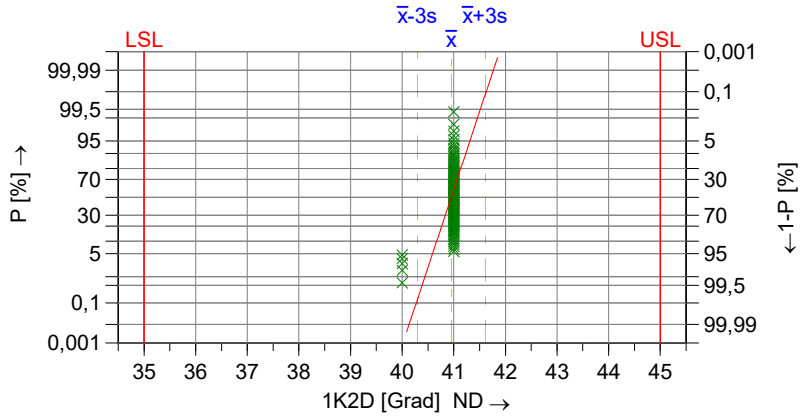
Ord. No.	1BD53T2O-A	Part type	1BD-1B060A-1K1D-1VK2D	Contr.item	yes
Serial No.	756028_k	Char.Descr.	1K2D	Inspection Val. 40,00 5,00	USL 45,00
		Serial No.	202852	Unit Grad -5,00	LSL 35,00
Char.Type	variable			Tolerance value 12 %	Decimal Pl. 2
Cust.Name	Cleco	Reference System	VM1698-4	Test Electronic	MPRO400GCD-P
Contr.No.	Homologation	Reference Transducer	50 / 1024729	nges.	100

Evaluation from 08.02.2022 11:05:52 to 08.02.2022 11:20:01

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			$\bar{x}$	40.9500
LSL	35.00	x_{min}	40.00	$\bar{x}$-3s	40.2929
USL	45.00	x_{max}	41.00	$\bar{x}$+3s	41.6071
T	10.00	R	1.00	6s	1.3143
		$n_{<T>}$	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	7.61
Critical capability index	=	C_{mk}	6.16

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

APEX VDI/VDE 2647 V0.1

Machine Capability Study
Tool System

Plant	ATG Westhausen		Operator Name	Sünder	Date 08.02.2022

Ser.No.	756028_k	Characteristic			
Type	1BD-1B060A-1K1D-1VK2D	Char.Descr.	1K2D	Inspection Val.	31,80
Ord. No.	1BD53T2O-A	Ser.No.	202852	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}
202852	1K2D	31,93	32,37	32,07	31,81	32,27	32,33	31,99	32,21	32,25	31,93
202852	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}
202852	1K2D	32,35	32,19	32,11	32,27	32,48	32,20	32,07	31,97	31,84	32,34
202852	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_{21}	x_{22}	x_{23}	x_{24}	x_{25}	x_{26}	x_{27}	x_{28}	x_{29}	x_{30}
202852	1K2D	32,39	32,43	32,28	32,12	31,91	32,10	32,44	32,19	32,10	32,53
202852	1K2D	41,00	41,00	41,00	41,00	41,00	41,00	41,00	41,00	41,00	41,00

Char.No.	Char.Descr.	x_{31}	x_{32}	x_{33}	x_{34}	x_{35}	x_{36}	x_{37}	x_{38}	x_{39}	x_{40}
202852	1K2D	32,41	32,43	32,27	32,08	31,84	31,87	31,93	31,88	31,57	31,96
202852	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}
202852	1K2D	31,80	31,66	31,97	31,89	31,79	31,89	31,75	31,66	31,75	31,94
202852	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}
202852	1K2D	31,88	31,91	31,82	32,14	31,83	31,77	31,94	31,71	32,02	32,00
202852	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}
202852	1K2D	32,16	31,91	32,24	32,04	31,76	31,61	31,92	32,09	31,71	32,11
202852	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}
202852	1K2D	31,59	31,70	31,76	31,97	32,23	31,90	31,86	31,87	31,86	32,05
202852	1K2D	41,00	41,00	41,00	41,00	41,00	41,00	41,00	41,00	40,00	40,00

Machine Capability Study
Tool System

Plant	ATG Westhausen		Operator Name	Sünder	Date 08.02.2022

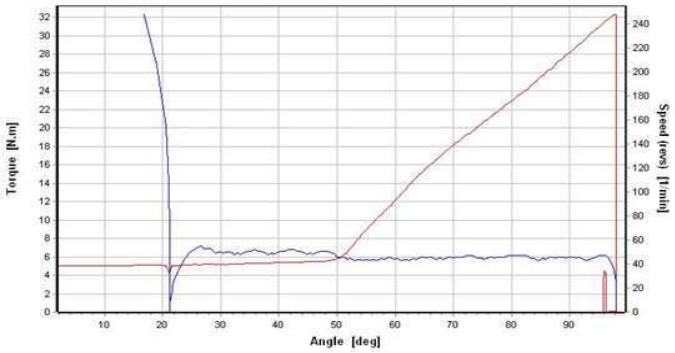
Ser.No.	756028_k	Characteristic			
Type	1BD-1B060A-1K1D-1VK2D	Char.Descr.	1K2D	Inspection Val.	31,80
Ord. No.	1BD53T2O-A	Ser.No.	202852	LSL	29,57
				USL	34,03
Remark	TQ 60% Angle 40°+/-5°* TQ-Cal.: 60.0 Nm; Cu r-Cal.: 3.8391 Nm/A; Speed: 300/50 rpm;				

Char.No.	Char.Descr.	x_{81}	x_{82}	x_{83}	x_{84}	x_{85}	x_{86}	x_{87}	x_{88}	x_{89}	x_{90}
202852	1K2D	32,04	32,08	32,23	32,28	31,86	31,80	31,94	32,20	31,86	31,65
202852	1K2D	41,00	41,00	41,00	41,00	41,00	41,00	41,00	41,00	41,00	41,00

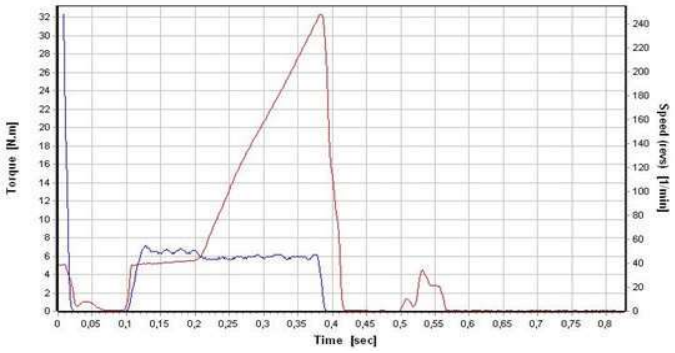
Char.No.	Char.Descr.	x_{91}	x_{92}	x_{93}	x_{94}	x_{95}	x_{96}	x_{97}	x_{98}	x_{99}	x_{100}
202852	1K2D	32,04	32,08	31,88	31,84	31,99	31,85	32,00	31,89	31,85	32,05
202852	1K2D	41,00	41,00	41,00	41,00	41,00	41,00	41,00	40,00	41,00	41,00

Torque graphs

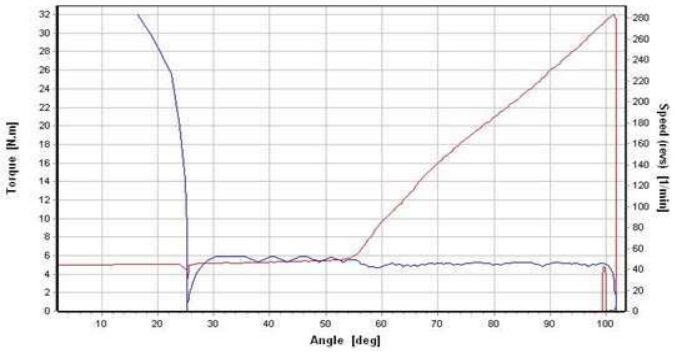
Model:	**1BD-1B060A-1K2D-1VK2D**	Serial no:	**756028**
Target torque:	**31,80 Nm**	60 % of max. torque	
Angle degree:	**40°**	Tool without angle correction	



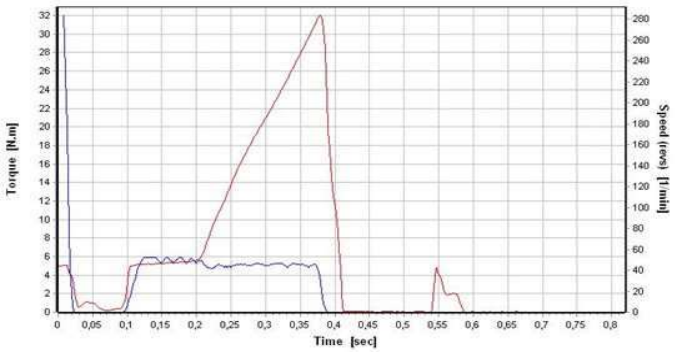
Value no. 1
Graph
Torque / Angle / Speed



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:** 756028

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: 4,57 % ± **2,29 %**

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

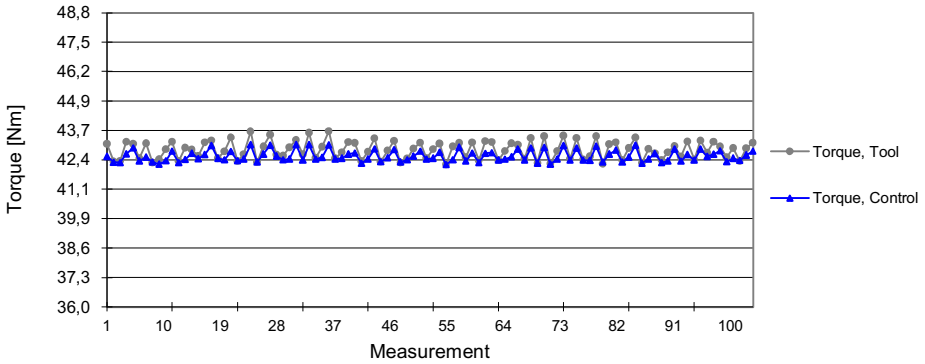
Formula derivation: $C_m = \frac{T}{6\,s}$ $T = C_m * 6\,s$

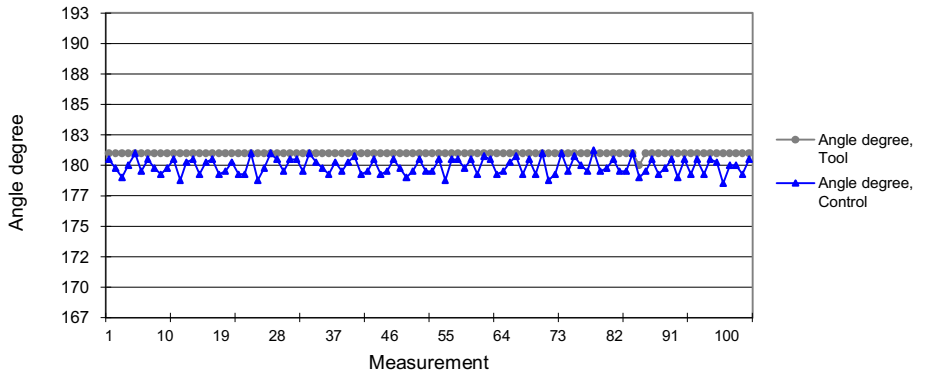
Tool without angle correction

Measurement	Tool data		Control data		Difference	
No.	Torque	Angle	Torque	Angle	Torque	Angle
1	43,08	181,00	42,54	180,50	0,54	0,50
2	42,33	181,00	42,29	179,75	0,04	1,25
3	42,35	181,00	42,28	179,00	0,07	2,00
4	43,18	181,00	42,65	180,00	0,53	1,00
5	43,08	181,00	42,91	181,00	0,17	0,00
6	42,46	181,00	42,35	179,50	0,11	1,50
7	43,10	181,00	42,52	180,50	0,58	0,50
8	42,27	181,00	42,30	179,75	0,03	1,25
9	42,42	181,00	42,21	179,25	0,21	1,75
10	42,85	181,00	42,36	179,75	0,49	1,25
11	43,18	181,00	42,78	180,50	0,40	0,50
12	42,34	181,00	42,27	178,75	0,07	2,25
13	42,92	181,00	42,41	180,25	0,51	0,75
14	42,84	181,00	42,68	180,50	0,16	0,50
15	42,56	181,00	42,45	179,25	0,11	1,75
16	43,16	181,00	42,62	180,25	0,54	0,75
17	43,24	181,00	43,01	180,50	0,23	0,50
18	42,47	181,00	42,47	179,25	0,00	1,75
19	42,77	181,00	42,40	179,50	0,37	1,50
20	43,36	181,00	42,76	180,25	0,60	0,75
21	42,34	181,00	42,36	179,25	0,02	1,75
22	42,64	181,00	42,43	179,25	0,21	1,75
23	43,62	181,00	43,05	181,00	0,57	0,00
24	42,30	181,00	42,30	178,75	0,00	2,25
25	42,97	181,00	42,64	179,75	0,33	1,25
26	43,48	181,00	43,03	181,00	0,45	0,00
27	42,61	181,00	42,56	180,50	0,05	0,50
28	42,57	181,00	42,40	179,50	0,17	1,50
29	42,94	181,00	42,44	180,50	0,50	0,50
30	43,26	181,00	43,05	180,50	0,21	0,50
31	42,62	181,00	42,39	179,50	0,23	1,50
32	43,57	181,00	43,05	181,00	0,52	0,00
33	42,48	181,00	42,42	180,25	0,06	0,75
34	42,96	181,00	42,50	179,75	0,46	1,25
35	43,64	181,00	43,04	179,25	0,60	1,75
36	42,46	181,00	42,43	180,25	0,03	0,75
37	42,73	181,00	42,47	179,50	0,26	1,50
38	43,17	181,00	42,64	180,25	0,53	0,75
39	43,12	181,00	42,69	180,75	0,43	0,25
40	42,34	181,00	42,24	179,25	0,10	1,75
41	42,75	181,00	42,43	179,50	0,32	1,50
42	43,33	181,00	42,87	180,50	0,46	0,50
43	42,32	181,00	42,32	179,25	0,00	1,75
44	42,80	181,00	42,49	179,50	0,31	1,50
45	43,22	181,00	42,84	180,50	0,38	0,50
46	42,27	181,00	42,31	179,75	0,04	1,25
47	42,45	181,00	42,40	179,00	0,05	2,00
48	42,88	181,00	42,55	179,50	0,33	1,50
49	43,13	181,00	42,78	180,50	0,35	0,50
50	42,47	181,00	42,42	179,50	0,05	1,50
51	42,86	181,00	42,47	179,50	0,39	1,50
52	43,09	181,00	42,73	180,50	0,36	0,50
53	42,19	181,00	42,19	178,75	0,00	2,25
54	42,98	181,00	42,40	180,50	0,58	0,50
55	43,12	181,00	42,94	180,50	0,18	0,50
56	42,50	181,00	42,35	179,75	0,15	1,25
57	43,15	181,00	42,69	180,50	0,46	0,50
58	42,37	181,00	42,28	179,25	0,09	1,75
59	43,21	181,00	42,67	180,75	0,54	0,25
60	43,17	181,00	42,70	180,50	0,47	0,50
61	42,38	181,00	42,39	179,25	0,01	1,75
62	42,78	181,00	42,42	179,50	0,36	1,50
63	43,10	181,00	42,53	180,25	0,57	0,75
64	43,04	181,00	42,86	180,75	0,18	0,25
65	42,44	181,00	42,39	179,25	0,05	1,75
66	43,34	181,00	42,91	180,50	0,43	0,50
67	42,25	181,00	42,25	179,25	0,00	1,75
68	43,42	181,00	42,93	181,00	0,49	0,00
69	42,23	181,00	42,21	178,75	0,02	2,25
70	42,78	181,00	42,43	179,25	0,35	1,75
71	43,44	181,00	43,01	181,00	0,43	0,00
72	42,44	181,00	42,38	179,50	0,06	1,50
73	43,34	181,00	42,90	180,75	0,44	0,25
74	42,41	181,00	42,38	180,00	0,03	1,00
75	42,54	181,00	42,37	179,50	0,17	1,50
76	43,42	181,00	42,99	181,25	0,43	0,25
77	42,22	181,00	42,30	179,50	0,08	1,50
78	43,07	181,00	42,64	179,75	0,43	1,25
79	43,16	181,00	42,82	180,50	0,34	0,50
80	42,39	181,00	42,30	179,50	0,09	1,50
81	42,91	181,00	42,52	179,50	0,39	1,50
82	43,36	181,00	43,03	181,00	0,33	0,00
83	42,26	180,00	42,24	179,00	0,02	1,00
84	42,87	181,00	42,44	179,50	0,43	1,50
85	42,68	181,00	42,66	180,50	0,02	0,50
86	42,39	181,00	42,27	179,25	0,12	1,75
87	42,73	181,00	42,35	179,75	0,38	1,25
88	42,99	181,00	42,86	180,50	0,13	0,50
89	42,53	181,00	42,34	179,00	0,19	2,00
90	43,19	181,00	42,62	180,50	0,57	0,50
91	42,41	181,00	42,38	179,25	0,03	1,75
92	43,23	181,00	42,86	180,50	0,37	0,50
93	42,70	181,00	42,54	179,25	0,16	1,75
94	43,18	181,00	42,63	180,50	0,55	0,50
95	42,97	181,00	42,79	180,25	0,18	0,75
96	42,50	181,00	42,32	178,50	0,18	2,50
97	42,91	181,00	42,47	180,00	0,44	1,00
98	42,34	181,00	42,37	180,00	0,03	1,00
99	42,90	181,00	42,60	179,25	0,30	1,75
100	43,14	181,00	42,78	180,50	0,36	0,50
				Standard deviation:	**0,193**	**0,648**

Graphical representation

Model:	**1BD-1B060A-1K2D-1VK2D**	Serial no:	**756028**
Target torque:	**42,40 Nm**	80 % of max. torque	
Angle degree:	**180°**	Tool without angle correction	





Machine Capability Study
Control System

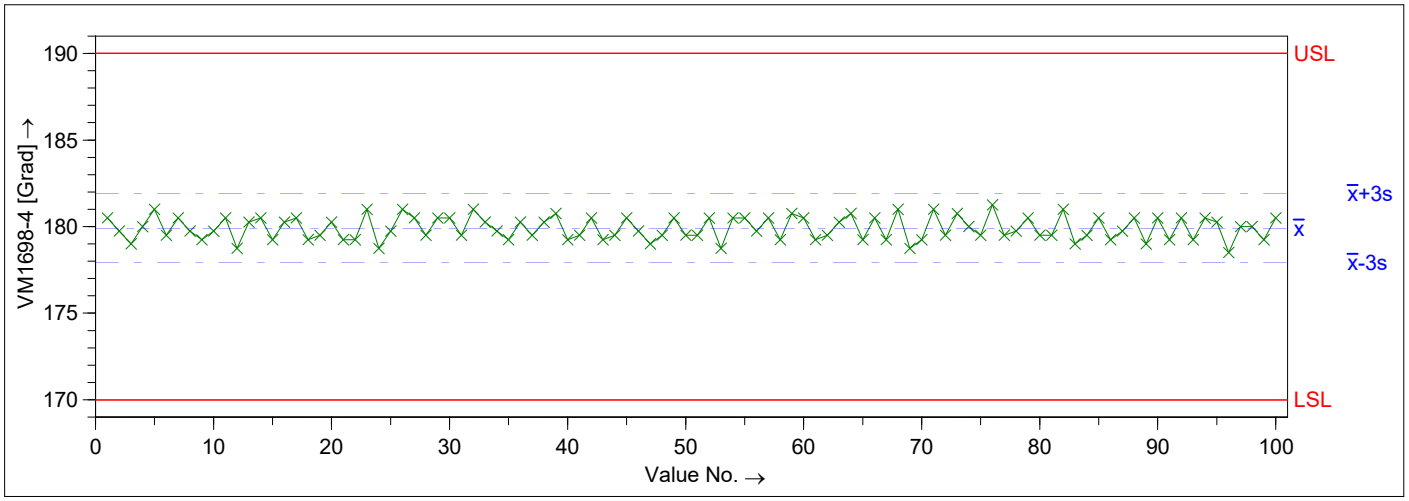
Cleco Production Tools

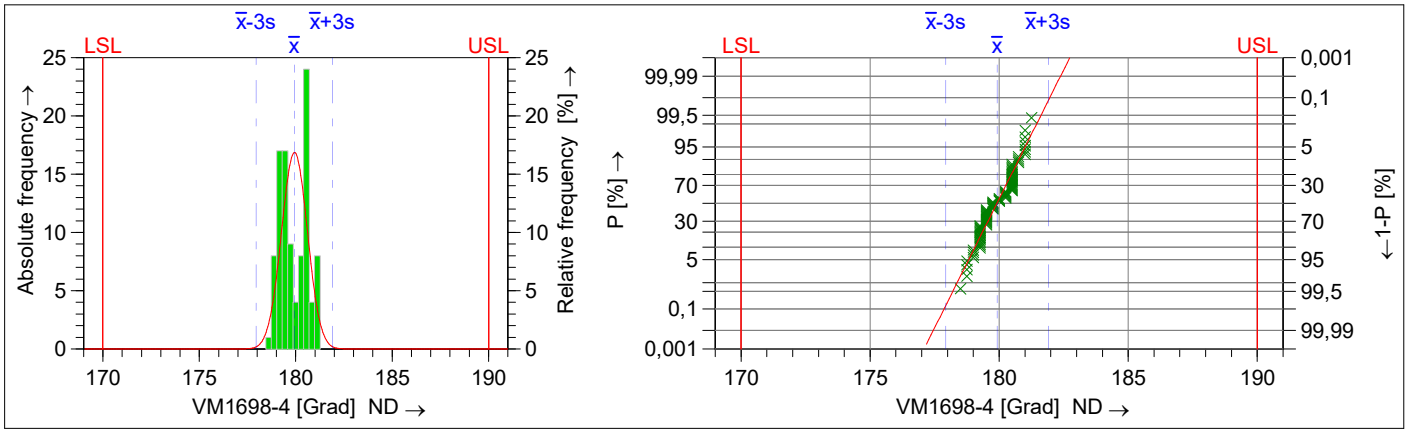
Plant	ATG Westhausen	Operator Name	Sünder
Date	08.02.2022		

Ord. No.	1BD53T2O-A	Part type	1BD-1B060A-1K1D-1VK2D	Contr.item	yes
Serial No.	756028_1	Char.Descr.	VM1698-4	Inspection Val. 180,00 10,00	USL 190,00
		Serial No.	1024210	Unit Grad -10,00	LSL 170,00
Char.Type	variable			Tolerance value 6 %	Decimal Pl. 2
Cust.Name	Cleco	Reference System	VM1698-4	Test Electronic	MPRO400GCD-P
Contr.No.	Homologation	Reference Transducer	50 / 1024729	nges.	100

Evaluation from 08.02.2022 11:22:46 to 08.02.2022 11:38:32

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			$\bar{x}$	179.9125
LSL	170.00	x_{min}	178.50	$\bar{x}$-3s	177.9257
USL	190.00	x_{max}	181.25	$\bar{x}$+3s	181.8993
T	20.00	R	2.75	6s	3.9736
		$n_{<T>}$	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	5.03
Critical capability index	=	C_{mk}	4.99

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 08.02.2022

Ser.No.	756028_I	Characteristic			
Type	1BD-1B060A-1K1D-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	42,54	42,29	42,28	42,65	42,91	42,35	42,52	42,30	42,21	42,36
1024210	VM1698-4	180,50	179,75	179,00	180,00	181,00	179,50	180,50	179,75	179,25	179,75

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	42,78	42,27	42,41	42,68	42,45	42,62	43,01	42,47	42,40	42,76
1024210	VM1698-4	180,50	178,75	180,25	180,50	179,25	180,25	180,50	179,25	179,50	180,25

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	42,36	42,43	43,05	42,30	42,64	43,03	42,56	42,40	42,44	43,05
1024210	VM1698-4	179,25	179,25	181,00	178,75	179,75	181,00	180,50	179,50	180,50	180,50

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	42,39	43,05	42,42	42,50	43,04	42,43	42,47	42,64	42,69	42,24
1024210	VM1698-4	179,50	181,00	180,25	179,75	179,25	180,25	179,50	180,25	180,75	179,25

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	42,43	42,87	42,32	42,49	42,84	42,31	42,40	42,55	42,78	42,42
1024210	VM1698-4	179,50	180,50	179,25	179,50	180,50	179,75	179,00	179,50	180,50	179,50

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	42,47	42,73	42,19	42,40	42,94	42,35	42,69	42,28	42,67	42,70
1024210	VM1698-4	179,50	180,50	178,75	180,50	180,50	179,75	180,50	179,25	180,75	180,50

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	42,39	42,42	42,53	42,86	42,39	42,91	42,25	42,93	42,21	42,43
1024210	VM1698-4	179,25	179,50	180,25	180,75	179,25	180,50	179,25	181,00	178,75	179,25

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	43,01	42,38	42,90	42,38	42,37	42,99	42,30	42,64	42,82	42,30
1024210	VM1698-4	181,00	179,50	180,75	180,00	179,50	181,25	179,50	179,75	180,50	179,50

Machine Capability Study
Control System

Plant	ATG Westhausen		Operator Name	Sünder	Date 08.02.2022

Ser.No.	756028_I	Characteristic			
Type	1BD-1B060A-1K1D-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	42,52	43,03	42,24	42,44	42,66	42,27	42,35	42,86	42,34	42,62
1024210	VM1698-4	179,50	181,00	179,00	179,50	180,50	179,25	179,75	180,50	179,00	180,50

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	42,38	42,86	42,54	42,63	42,79	42,32	42,47	42,37	42,60	42,78
1024210	VM1698-4	179,25	180,50	179,25	180,50	180,25	178,50	180,00	180,00	179,25	180,50

Machine Capability Study
Tool System

Cleco Production Tools

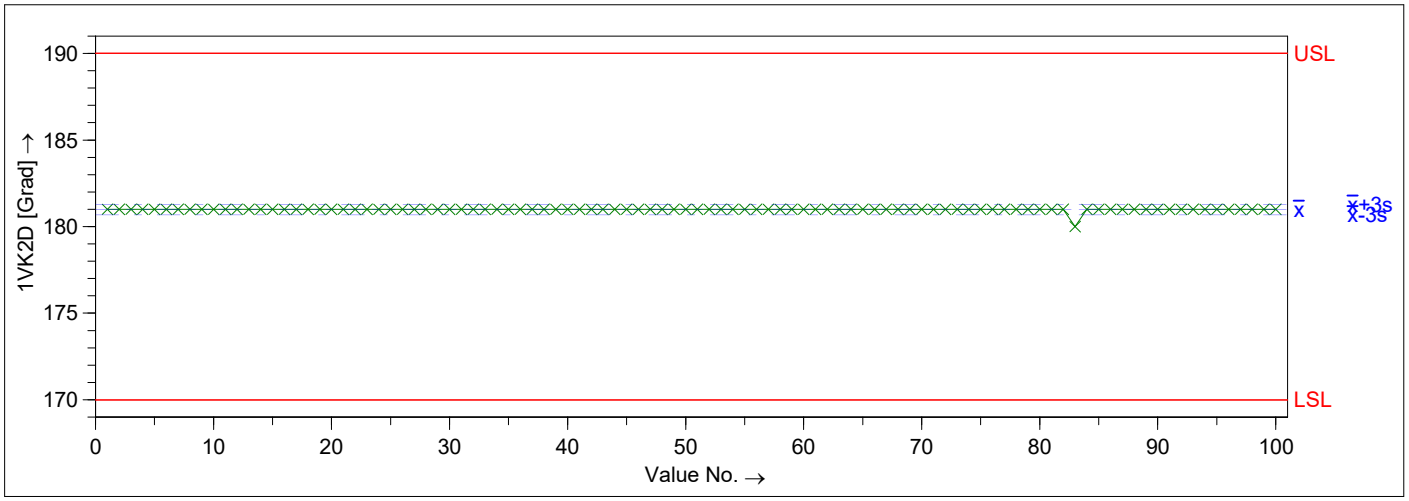
Plant ATG Westhausen		Operator Name Sünder	Date 08.02.2022

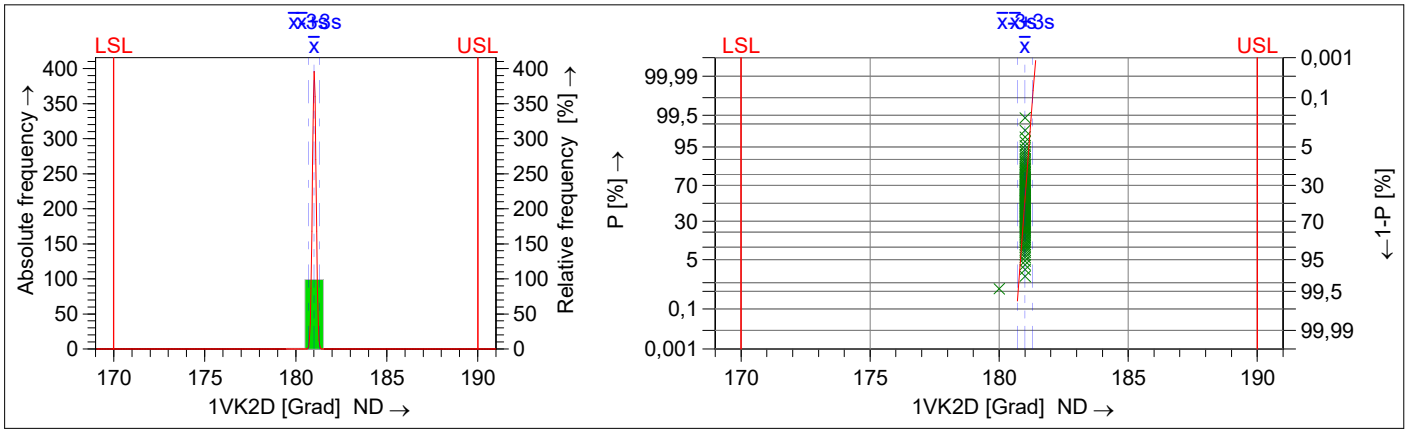
Ord. No. 1BD53T2O-A	Part type 1BD-1B060A-1K1D-1VK2D				Contr.item yes
Serial No. 756028_1	Char.Descr. 1VK2D	Inspection Val.	180,00	10,00	USL 190,00
	Serial No. 200693_1	Unit	Grad	-10,00	LSL 170,00
Char.Type variable		Tolerance value	6 %		Decimal Pl. 2

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

Evaluation from 08.02.2022 11:22:46 to 08.02.2022 11:38:32

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			$\bar{x}$	180.9900
LSL	170.00	x_{min}	180.00	$\bar{x}$-3s	180.6900
USL	190.00	x_{max}	181.00	$\bar{x}$+3s	181.2900
T	20.00	R	1.00	6s	0.6000
		$n_{<T>}$	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	33.33
Critical capability index	=	C_{mk}	30.03

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 08.02.2022

Ser.No.	756028_l	Characteristic			
Type	1BD-1B060A-1K1D-1VK2D	Char.Descr.	1VK2D	Inspection Val.	42,40
Ord. No.	1BD53T2O-A	Ser.No.	200693_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}
200693_	1VK2D	43,08	42,33	42,35	43,18	43,08	42,46	43,10	42,27	42,42	42,85
200693_	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}
200693_	1VK2D	43,18	42,34	42,92	42,84	42,56	43,16	43,24	42,47	42,77	43,36
200693_	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}
200693_	1VK2D	42,34	42,64	43,62	42,30	42,97	43,48	42,61	42,57	42,94	43,26
200693_	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}
200693_	1VK2D	42,62	43,57	42,48	42,96	43,64	42,46	42,73	43,17	43,12	42,34
200693_	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}
200693_	1VK2D	42,75	43,33	42,32	42,80	43,22	42,27	42,45	42,88	43,13	42,47
200693_	1VK2D	181,00	181,00	181,00	181,00	181,00	181,00	181,00	181,00	181,00	181,00

Char.No.	Char.Descr.	x_{51}	x_{52}	x_{53}	x_{54}	x_{55}	x_{56}	x_{57}	x_{58}	x_{59}	x_{60}
200693_	1VK2D	42,86	43,09	42,19	42,98	43,12	42,50	43,15	42,37	43,21	43,17
200693_	1VK2D	181,00	181,00	181,00	181,00	181,00	181,00	181,00	181,00	181,00	181,00

Char.No.	Char.Descr.	x_{61}	x_{62}	x_{63}	x_{64}	x_{65}	x_{66}	x_{67}	x_{68}	x_{69}	x_{70}
200693_	1VK2D	42,38	42,78	43,10	43,04	42,44	43,34	42,25	43,42	42,23	42,78
200693_	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}
200693_	1VK2D	43,44	42,44	43,34	42,41	42,54	43,42	42,22	43,07	43,16	42,39
200693_	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 08.02.2022

Ser.No.	756028_l	Characteristic			
Type	1BD-1B060A-1K1D-1VK2D	Char.Descr.	1VK2D	Inspection Val.	42,40
Ord. No.	1BD53T2O-A	Ser.No.	200693_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}
200693_	1VK2D	42,91	43,36	42,26	42,87	42,68	42,39	42,73	42,99	42,53	43,19
200693_	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_{91}	x_{92}	x_{93}	x_{94}	x_{95}	x_{96}	x_{97}	x_{98}	x_{99}	x_{100}
200693_	1VK2D	42,41	43,23	42,70	43,18	42,97	42,50	42,91	42,34	42,90	43,14
200693_	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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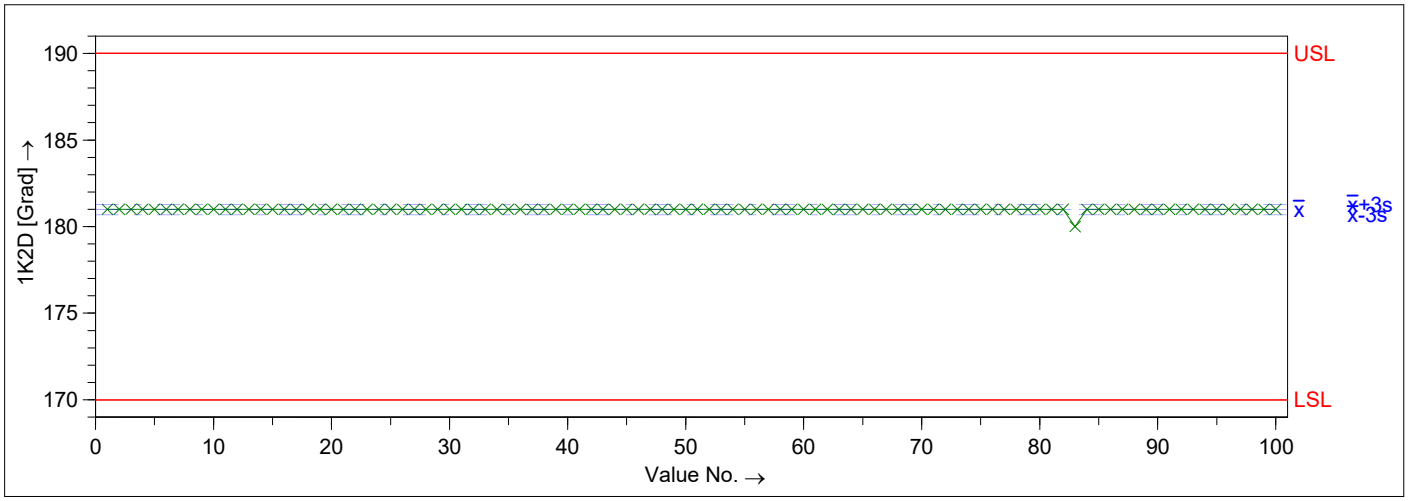
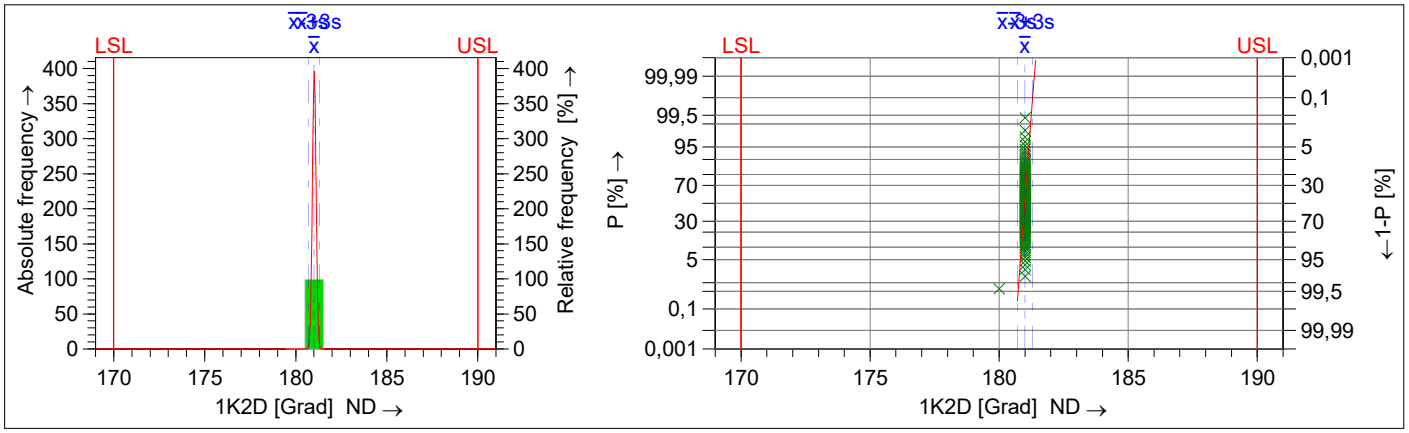
Plant ATG Westhausen		Operator Name Sünder	Date 08.02.2022

Ord. No. 1BD53T2O-A	Part type 1BD-1B060A-1K1D-1VK2D				Contr.item yes
Serial No. 756028_1	Char.Descr. 1K2D	Inspection Val.	180,00	10,00	USL 190,00
	Serial No. 202852	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 08.02.2022 11:22:46 to 08.02.2022 11:38:32

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			$\bar{x}$	180.9900
LSL	170.00	x_{min}	180.00	$\bar{x}$-3s	180.6900
USL	190.00	x_{max}	181.00	$\bar{x}$+3s	181.2900
T	20.00	R	1.00	6s	0.6000
		$n_{<T>}$	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	33.33
Critical capability index	=	C_{mk}	30.03

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 08.02.2022

Ser.No.	756028_I	Characteristic			
Type	1BD-1B060A-1K1D-1VK2D	Char.Descr.	1K2D	Inspection Val.	42,40
Ord. No.	1BD53T2O-A	Ser.No.	202852	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}
202852	1K2D	42,49	42,25	42,14	42,65	42,85	42,23	42,67	41,98	42,27	42,11
202852	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}
202852	1K2D	42,66	41,93	42,01	42,38	42,45	42,60	42,91	42,53	42,46	42,76
202852	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}
202852	1K2D	42,46	42,34	43,04	42,09	42,36	43,07	42,60	42,09	42,13	42,99
202852	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}
202852	1K2D	42,28	42,92	42,40	42,32	43,05	42,51	42,31	42,32	42,66	42,11
202852	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}
202852	1K2D	42,33	42,78	42,27	42,27	42,68	42,14	42,12	42,22	42,40	42,43
202852	1K2D	181,00	181,00	181,00	181,00	181,00	181,00	181,00	181,00	181,00	181,00

Char.No.	Char.Descr.	x_{51}	x_{52}	x_{53}	x_{54}	x_{55}	x_{56}	x_{57}	x_{58}	x_{59}	x_{60}
202852	1K2D	42,35	42,53	41,89	42,28	42,74	42,20	42,65	42,37	42,46	42,75
202852	1K2D	181,00	181,00	181,00	181,00	181,00	181,00	181,00	181,00	181,00	181,00

Char.No.	Char.Descr.	x_{61}	x_{62}	x_{63}	x_{64}	x_{65}	x_{66}	x_{67}	x_{68}	x_{69}	x_{70}
202852	1K2D	42,06	42,18	42,23	42,57	42,36	42,92	42,03	42,99	42,05	42,38
202852	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}
202852	1K2D	42,90	42,43	42,50	42,17	42,15	42,61	42,08	42,42	42,58	42,03
202852	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 08.02.2022

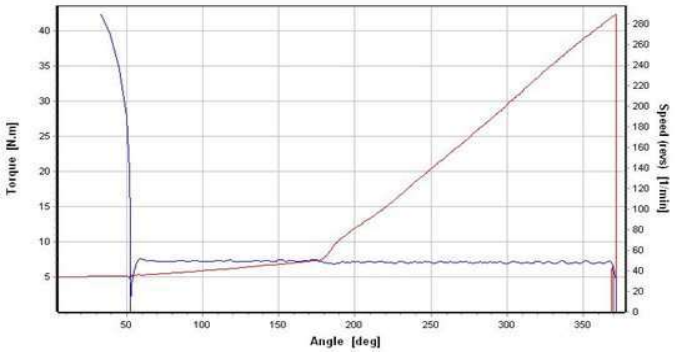
Ser.No.	756028_I	Characteristic			
Type	1BD-1B060A-1K1D-1VK2D	Char.Descr.	1K2D	Inspection Val.	42,40
Ord. No.	1BD53T2O-A	Ser.No.	202852	LSL	39,43
				USL	45,37
Remark	TQ 80% Angle 180°+/-10°* TQ-Cal.: 60.0 Nm; Cur-Cal.: 3.8391 Nm/A; Speed: 300/50 rpm;				

Char.No.	Char.Descr.	x_{81}	x_{82}	x_{83}	x_{84}	x_{85}	x_{86}	x_{87}	x_{88}	x_{89}	x_{90}
202852	1K2D	42,58	42,81	42,20	42,24	42,36	42,27	42,13	42,44	42,42	42,81
202852	1K2D	181,00	181,00	180,00	181,00	181,00	181,00	181,00	181,00	181,00	181,00

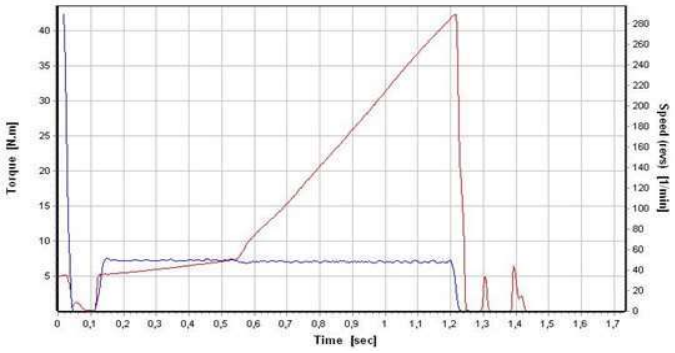
Char.No.	Char.Descr.	x_{91}	x_{92}	x_{93}	x_{94}	x_{95}	x_{96}	x_{97}	x_{98}	x_{99}	x_{100}
202852	1K2D	42,16	42,56	42,32	42,45	42,58	42,36	42,34	42,30	42,46	42,66
202852	1K2D	181,00	181,00	181,00	181,00	181,00	181,00	181,00	181,00	181,00	181,00

Torque graphs

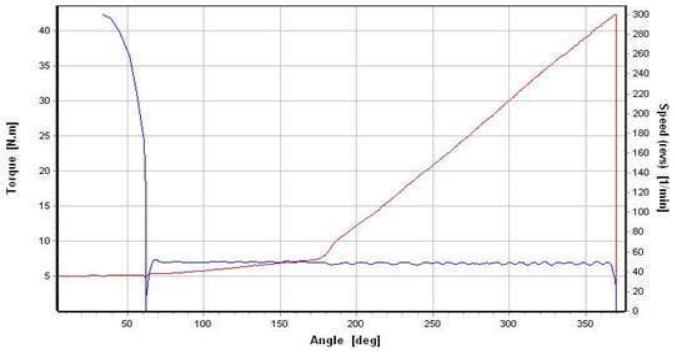
Model:	**1BD-1B060A-1K2D-1VK2D**	Serial no:	**756028**
Target torque:	**42,40 Nm**	80 % of max. torque	
Angle degree:	**180°**	Tool without angle correction	



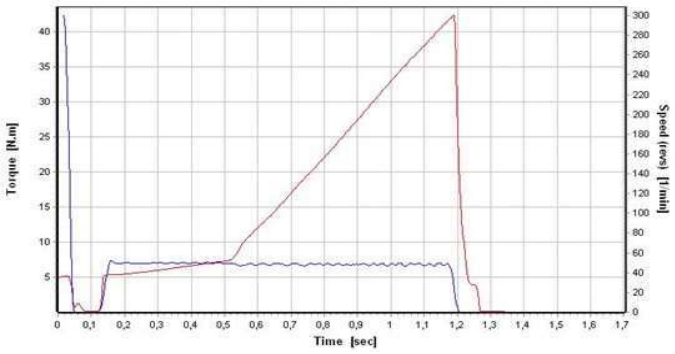
Value no. 1
Graph
Torque / Angle / Speed



Value no. 1
Graph
Torque / Time / Speed



Value no. 100
Graph
Torque / Angle / Speed



Value no. 100
Graph
Torque / Time / Speed