Prüfbericht : **Maschinenfähigkeitsuntersuchung (MFU) von Akku-Industrieschraubern**

C. & E. FEIN GmbH
Schwäbisch Gmünd
Hans-Fein-Str. 81, D-73529 Schwäbisch Gmünd-Bargau

Maschinenart	: Stabwinkelschrauber	**Datum :**	13.04.2016
Modell Variante	: ASW 18-60PC		
Hersteller	: C.&E. Fein		
Entwicklungs-Nr.	: 6916		
Entwicklungsstand	: Serie		
MFU - Typ	: Homologation		
Stufenzahl	: 1-stufig	**Prüfstands - Nr. :**	

Verschraubungsklasse :	2
Verschraubungstoleranz T =	10,0%

1	**2**	3	4	5	6
5,0%	**10,0%**	12,0%	15,0%	20,0%	25,0%

Drehmomentbereich :	M_{min} =	35,00	Nm	M_{max} =	60,00	Nm
Leerlaufdrehzahl :	n =	100	min^{-1}	n_2 =		min^{-1}
Akkuspannung :	U =	18,00	V	$M_{Schwell}$ =		Nm
Akkukapazität :	Q =	5000	mAh	**Unterspannungserkennung :**	☑	
Gewicht inkl. Akku :	m =		kg			
Schalldruckpegel :	L_{pfA} =		dB(A)			

Eingabefeld	... bitte gelbe Eingabefelder ausfüllen

Drehmomentbereich Homologation : **Testmaschinen :** 3 **Stück**

	30%	➔	M30%	= Mmin + 30% x (Mmax -Mmin) =	42,50 Nm
	80%	➔	M80%	= Mmin + 80% x (Mmax -Mmin) =	55,00 Nm
Mmax =	100%	➔	M100%	= Mmin + 100% x (Mmax -Mmin) =	60,00 Nm

	Name :	Datum :	Unterschrift :
Prüfung durchgeführt durch :	Hollndonner	13.04.2016	
Prüfbericht erstellt durch :	Walz	13.04.2016	

Verteiler :

MAP	KAM	EW	EWD	EWB	EGE
☐	☐	☑	☑	☐	☐

Testbench Measuring

MCS for FEIN-Projekt : 6916 | Homologation | Date: 13.04.2016

ASW 18-60PC | ScrewdriverType ASW | Spring Rate 0,00 N/mm | f_{mess} = 300 Hz | T_{min} | T_{max}

Serial Number | Variant : 18-60PC | Accuracy-Class 10,0% | Class : 2 | T_{range} = 35,00 upto 60,00 Nm

see Marking below | Mean Value Offset | Transmission: i = 1: 51,04 | n_{given} = 100 rpm | U = 18,00 V

Anglehead: i_{WK} = 1: 1,60 | $i_{complete}$ = 1 : 81,67 | LoadChanges: 100

MCS	T_d [Nm]	Angle [°]	T_q [Nm]	$\Delta T_{q\ 1/2\ 2/3}$ [Nm]	$\Delta T_{q\ 1/3}$ [Nm]	s [Nm]	c_m [1]	c_{mk} [1]	n [min^{-1}]			Remarks
1	60,00	030°	59,806	0,110		0,796	2,587	2,504	100	2016-03.022515	100,0%	
1	60,00	120°	59,696		-0,035	0,759	2,635	2,502	100			
1	60,00	360°	59,841	-0,145		0,681	2,937	2,859	100			
1	55,00	030°	55,024			0,707	2,593	2,582	100		80,0%	
1	55,00	120°	55,204	-0,180	-0,611	0,747	2,454	2,363	100			
1	55,00	360°	55,635	-0,431		0,661	2,774	2,453	100			
1	42,50	030°	42,963			0,595	2,381	2,122	100		30,0%	
1	42,50	120°	42,707	0,256	-0,138	0,625	2,267	2,156	100			
1	42,50	360°	43,101	-0,394		0,403	3,515	3,018	100			
1	60,00	030°	59,747			0,815	2,454	2,351	100	2016-03.022526	100,0%	
1	60,00	120°	60,225	-0,478	-0,870	0,718	2,786	2,681	100			
1	60,00	360°	60,617	-0,392		0,569	3,515	3,153	100			
1	55,00	030°	55,547			0,692	2,649	2,386	100		80,0%	
1	55,00	120°	55,694	-0,147	-0,266	0,695	2,638	2,305	100			
1	55,00	360°	55,813	-0,119		0,557	3,291	2,805	100			
1	42,50	030°	42,789			0,560	2,530	2,358	100		30,0%	
1	42,50	120°	42,960	-0,171	-0,404	0,563	2,516	2,244	100			
1	42,50	360°	43,193	-0,233		0,445	3,184	2,664	100			
1	60,00	030°	59,345			0,949	2,107	1,877	100	2016-03.022527	100,0%	
1	60,00	120°	59,430	-0,085	-0,497	0,752	2,660	2,407	100			
1	60,00	360°	59,842	-0,412		0,630	3,175	3,091	100			
1	55,00	030°	55,303			0,694	2,642	2,496	100		80,0%	
1	55,00	120°	55,352	-0,049	-0,083	0,730	2,511	2,351	100			
1	55,00	360°	55,386	-0,034		0,556	3,297	3,066	100			
1	42,50	030°	42,545			0,566	2,503	2,476	100		30,0%	
1	42,50	120°	42,428	0,117	0,151	0,479	2,958	2,907	100			
1	42,50	360°	42,394	0,034		0,340	4,167	4,063	100			

Input of the head-data (grew):

Input of T_q, s and n (yellow Fields)

Input of n, Machinen-Numbers and Marks

Homologation : 3 Machines out of a series, each 30%, 80% and 100% the torque-ranges.

100% : $M_{100\%} = M_{min} + 100\%*(M_{max} - M_{min})$, Waitingtime $\Delta t_{100\%}$ = 30 s between the loadchanges.

80% : $M_{80\%} = M_{min} + 80\%*(M_{max} - M_{min})$, Waitingtime $\Delta t_{80\%}$ = 15 s between the loadchanges.

30% : $M_{30\%} = M_{min} + 30\%*(M_{max} - M_{min})$, Waitingtime $\Delta t_{30\%}$ = 5 s between the Loadchanges.

Series of measurement per machine, Nominal Torque and Screwinghardness each 100 Load changes (LW).

$c_{m\ min}$ =	2,107	$c_{m\ q}$ =	2,805	$c_{m\ max}$ =	4,167	s_{cm} =	0,448
$c_{mk\ min}$ =	1,877	$c_{mk\ q}$ =	2,601	$c_{mk\ max}$ =	4,063	n_{MFU} =	027

c_{mkc}…optimale adjustable Value by manuelle Torque correction

$c_{m\ min}$	=	c_m - Minimum Value
$c_{mk\ min}$	=	c_m - Minimum Value
		c_m - Minimum Value
$c_{m\ q}$	=	c_m - Mid Value
$c_{mk\ q}$	=	c_m - Mid Value
		c_m - Mid Value
$c_{m\ max}$	=	c_m - Maximum Value
$c_{mk\ max}$	=	c_m - Maximum Value
		c_m - Maximum Value
s_{cm}	=	c_m - Standard deviation
s_{cmk}	=	c_{mk} - Standard deviation
n_{MCS}	=	No. of Machine Capability Study (MCS
c	=	correktion value

Name: Walz

Projekt: 6916 : ASW 18-60PC

C. & E. FEIN GmbH
Schwäbisch Gmünd

Stage of Development :
Serie

Test report: **Machine capability study (MFU) of battery-powered industrial screwdrivers**

C. & E. FEIN GmbH
Schwäbisch Gmünd
Hans-Fein-Str. 81, D-73529
Schwäbisch Gmünd-Bargau

Maschine type	: Angle head screwdriver	**Date:**	30.03.2020
Model variant:	ASW 18-60-PC		
Manufacturer:	C.&E. Fein GmbH		

Development status	Series		
MCI - Typ:	Homologation		
Number of steps :	1-step	**Test bench - ID:**	1026164

Screw connection class :	2
Screw joint tolerance	10,0%

1	**2**	3	4	5	6
5,0%	**10,0%**	12,0%	15,0%	20,0%	25,0%

Torque range:	M_{min} =	35,00	Nm		M_{max} =	60,00	Nm
Idle speed:	n =	135	min^{-1}	**Weight incl. battery:**	m =	2,35	kg
Battery voltage:	U =	18,0	V	**Sound pressure level:**	L_{pA} =	81	dB(A)
Battery capacity:	Q =	6000	mAh	**Undervoltage detection:**		☑	
Torque range investigation :				**Test Maschines:**		3	piece

	30%	→ M30%	= Mmin + 30% x (Mmax -Mmin) =	42,50	Nm
	80%	→ M80%	= Mmin + 80% x (Mmax -Mmin) =	55,00	Nm
Mmax =	100%	→ M100%	= Mmin + 100% x (Mmax -Mmin) =	60,00	Nm

Information on all 3 test items

Load level		30%		80%		100%	
Test torque	M_d =	42,50		55,00		60,00	
screw joint		hard	soft	hard	soft	hard	soft
		30°	360°	30°	360°	30°	360°
$c_{m\,min}$ =		2,562	3,034	2,390	2,712	2,766	2,782
$c_{mk\,min}$ =		2,316	3,019	2,364	2,534	2,633	2,638
torsion angle range		> 0°					

		Name :	**Date :**
Test performed by	:	M. Mueck	30.03.2020
Test report prepared by	:	M. Burkhardt	31.03.2020

Testbench Measuring

MCA for FEIN-Project : 0 | **Homologation** | Date: 30.03.2020

ASW 18-60PC

ScrewdriverType ASW | Accuracy-Class 10,0% | Class : 2 | f_{mess} = 300 Hz | M_{min} | M_{max}

Variant : 18-60PC | M_{range} = 35,00 up to 60,00 Nm | n_{given} = 135 rpm | U = 18,00 V

cycles: 100

MCSs	M_d [Nm]	Angle [°]	M_q [Nm]	$\Delta M_{q\,1/2}$ [Nm]	s [Nm]	c_m [1]	c_{mk} [1]	n [min^{-1}]			Remarks
1	35,00	360°	34,930	0,507	0,242	4,821	4,725	142	2016-03.022515	0%	
1	35,00	30°	34,423		0,233	5,007	4,182	146			
1	42,50	360°	42,604	0,125	0,193	7,340	7,161	140		30%	
1	42,50	30°	42,479		0,265	5,346	5,319	139			
1	55,00	360°	55,254	0,508	0,285	6,433	6,136	142		80%	
1	55,00	30°	54,746		0,376	4,876	4,651	139			
1	60,00	360°	60,144	0,369	0,356	5,618	5,483	143		100%	
1	60,00	30°	60,513		0,483	4,141	3,787	143			
2	35,00	360°	35,004	0,141	0,178	6,554	6,547	143	2016-03.022526	0%	
2	35,00	30°	35,145		0,242	4,821	4,621	140			
2	42,50	360°	42,494	0,743	0,356	3,979	3,974	143		30%	
2	42,50	30°	41,751		0,484	2,927	2,411	144			
2	55,00	360°	55,256	0,092	0,502	3,652	3,482	145		80%	
2	55,00	30°	55,164		0,562	3,262	3,165	145			
2	60,00	360°	59,839	0,064	0,598	3,344	3,255	145		100%	
2	60,00	30°	59,775		0,676	2,959	2,848	146			
3	35,00	360°	34,821	0,058	0,366	3,188	3,025	147	2016-03.022527	0%	
3	35,00	30°	34,879		0,420	2,778	2,682	147			
3	42,50	360°	42,480	0,388	0,467	3,034	3,019	144		30%	
3	42,50	30°	42,092		0,553	2,562	2,316	148			
3	55,00	360°	55,361	0,301	0,676	2,712	2,534	144		80%	
3	55,00	30°	55,060		0,767	2,390	2,364	146			
3	60,00	360°	60,310	0,600	0,719	2,782	2,638	145		100%	
3	60,00	30°	59,710		0,723	2,766	2,633	147			

Start of measurement: 09:00

End of measurement: 16:00

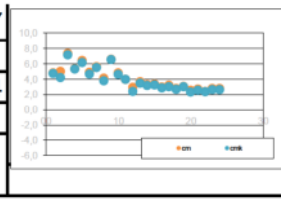
Homologation : 3 Machines out of a series, each 0%, 30%, 80% and 100% the torque-ranges.

Waitingtime between Load cycles 2 sec.

Series of measurements per machine, nominal torque and screw joint density per 100 load cycles (LW).

Measurment based on VDI 2647 February 2013

$c_{m\ min}$ =	2,390	$c_{m\ q}$ =	4,054	$c_{m\ max}$ =	7,340	s_{cm} =	1,397
$c_{mk\,min}$ =	2,316	$c_{mk\ q}$ =	3,873	$c_{mk\,max}$ =	7,161	n_{MFU} =	24



$c_{m\,min}$ = c_m - Minimum Value

$c_{m\,q}$ = c_m - Mid Value

$c_{mk\,q}$ = c_m - Mid Value

$c_{m\,max}$ = c_m - Maximum Value

$c_{mk\,max}$ = c_m - Maximum Value

s_{cm} = c_m - Standard deviation

s_{cmk} = c_{mk} - Standard deviation

$\breve{c}$ = correktion value

Name: M. Mueck | Project:

C. & E. FEIN GmbH
Schwäbisch Gmünd

Development Status : Series