QA MATRIX SHEET

Date	20.07.2019

※PQCS / FMEA Sheet must be attached

Total	Category	Nos	Cp/Cpk ≥1.33	Cp/Cpk <1.33	Double or More Check	PAC-V OK	PAC-V NG	Supplier		HMSI
19	Measurable	13	13		13	0		Quality Head	In charge	Approved by	Checked by
	Non Measurable	6			4	0				

Model	KOVA	Part no.	23111-K0NA-D014-H1	Part name	GEAR PRIMARY DRIVEN	DCN	KONA-E-118	MAP -BLR

To process-based, please write if there is a change in the new process (Use V for marking)

PQCS ≪Base process flow≫
☐ Base Model
☐ Base Plant

PQCS ≪New process flow≫
☐ New Model
☐ New Plant
☐ New Supplier

Process columns: RECEIVING INSPECTION | HOBBING | SHAVING | PRE WASHING | INDUCTION HARDENING | HARD TURNING | ROLL TESTING | CRACK DETECTION | VISUAL INSPECTION | FINAL INSPECTION

Mark in necessary item against above mentioned process
① No change from base - ●
② There is a change from base - ★

4M situation:

	RECEIVING INSPECTION	HOBBING	SHAVING	PRE WASHING	INDUCTION HARDENING	HARD TURNING	ROLL TESTING	CRACK DETECTION	VISUAL INSPECTION	FINAL INSPECTION
Raw materials	●	●	●	●	●	●	●	●	●	●
Die Maintenance										
Equipment		●	●	●	●	●	●	●	●	●
Jig and Fixture		●	●	●	●	★	●	●	●	●
Mfg. Tools		★	★	●	●	★	●	●	●	●
Insp. Tool		★	★	●	●	●	★	●	●	●
Operator training	★	★	★	★	★	★	★	★	★	★
PQCS	★	★	★	★	★	★	★	★	★	★
Work Std.	★	★	★	★	★	★	★	★	★	★
Check sheet	★	★	★	★	★	★	★	★	★	★

≪Change point note column≫
Detail of change point etc.

≪Part feature note column≫
Specific information about 4M situation
HOBBING -CUTTER CHANGE
SHAVING- TAIL STOCK & CUTTER CHANGE
HARD TURNING - LOCATOR CHANGE

Process Assurance Capability - Verification
(PAC-V) will be OK if -
1. Process Assurance (Type a, & b) result are OK for Critical items.
2. Critical items included in PQCS and Operation Std.
3. Operator aware about Critical item's importance.
Note : For any deviation / change request Supplier must inform Purchase and SQA.

Type a. Measurable items (Examples)
1) Variable Dimensions
2) Torques
3) Destructive Hardness tests
4) Weld penetration
5) Cross Section dimension for which part cut is must

Type b. Non Measurable items (Complex)
i) Assembly (Coupler, Outlet terminal, etc.)
ii) Visual Inspection
iii) Grease / Oil /Adhesive applications
iv) Manufacturing process parameters
v) Specification test
vi) Material

No.	Critical item	Control value	Insp. Tool		Inspection process : ■														Measurable/ Non-Measurable	Cp/Cpk	No of Inspection	Included in PQCS	Included in Ope. Std.	Operator Awareness	PAC-V	Remarks
1	Gear Both ends Face Roughness	Rz12.5 MAX	R Tester	— / Freq	■ HOBBING / EACH/LOT								■ FINAL / 1/LOT						Measurable	4.07	2	o	o	o	OK	
1A	Gear Both ends Face Roughness	Rz12.5 MAX	R Tester	— / Freq	■ HOBBING / EACH/LOT								■ FINAL / 1/LOT						Measurable	3.46	2	o	o	o	OK	
2	Gear Face Roughness	Rz6.3 MAX	ROUGHNESS TESTER	— / Freq	■ SHAVING / 1/Setup & tc								■ FINAL / 1/LOT						Measurable	1.97	2	o	o	o	OK	
3	BRG part inner diameter	23 +0.021	AIR PLUG GAUGE/ AIR RING GAGE	— / Freq						■ HARD TURNING / 1/SETUP & TC/ FM				■ FINAL / 5/LOT					Measurable	1.47	2	o	o	o	OK	
4	BRG outer diameter	φ30.5-0.010 -0.030	AIR PLUG GAUGE/ AIR RING GAGE	— / Freq						■ HARD TURNING / 1/SETUP & TC/ FM				■ FINAL / 5/LOT					Measurable	1.43	2	o	o	o	OK	
5	Inside gear, inner diameter surface roughness	Rz 6.3	ROUGHNESS TESTER	— / Freq						■ HARD TURNING / 1/SETUP & TC/ 1SHIFT				■ FINAL / 1/LOT					Measurable	2.74	2	o	o	o	OK	
5A	Inside gear, Inner diameter surface roughness ON φ 30.5	Rz 6.3	ROUGHNESS TESTER	— / Freq						■ HARD TURNING / 1/SETUP & TC/ 1SHIFT				■ FINAL / 1/LOT					Measurable	1.50	2	o	o	o	OK	
6	Straddles GEAR M (Measurement of all circumference)	35.810 0.012./-0.052	FLANGE MIC	— / Freq															—	—	—	—	—	—	—	REFERANCE DIMENSION
7	Confirmation gear appearance	No dent and scratch , on chip and tooth side	VISUAL	— / Freq	■ SHAVING / 1/SETUP & TC						100%			■ FINAL / 5/LOT					NOn -Measurable	—	3	o	o	o	OK	
8	Pressure angle error (One center)	FA : 7 ±5µm	TOOTH PROFILE GEAR TESTER	— / Freq	■ SHAVING / 1/SETUP & TC/ FM/SHIFT									■ FINAL / 5/LOT					Measurable	1.46	2	o	o	o	OK	
8A	Pressure angle error (One center)	FA : 7 ±5µm	TOOTH PROFILE GEAR TESTER	— / Freq	■ SHAVING / 1/SETUP & TC/ FM/SHIFT									■ FINAL / 5/LOT					Measurable	1.42	2	o	o	o	OK	
9	Drill (One center)	TC : 0 +4 µm	TOOTH PROFILE GEAR TESTER	— / Freq	■ SHAVING / 1/SETUP & TC/ FM/SHIFT									■ FINAL / 5/LOT					Measurable	1.33	2	o	o	o	OK	
9A	Drill (One center)	TC : 0 +4 µm	TOOTH PROFILE GEAR TESTER	— / Freq	■ SHAVING / 1/SETUP & TC/ FM/SHIFT									■ FINAL / 5/LOT					Measurable	1.44	2	o	o	o	OK	
10	Tip correctionl (One center)	FFT : 5 ±5 µm	TOOTH PROFILE GEAR TESTER	— / Freq	■ SHAVING / 1/SETUP & TC/ FM/SHIFT									■ FINAL / 5/LOT					Measurable	1.44	2	o	o	o	OK	

QA MATRIX SHEET

Date	20.07.2019	※PQCS / FMEA Sheet must be attached

Model	KOVA	Part no.	23111-K0NA-D014-H1	Part name	GEAR PRIMARY DRIVEN	DCN	KONA-E-118		MAP -BLR

Supplier name

Total		Category	NOS	Cp/Cpk ≥1.33	Cp/Cpk <1.33	Double or More Check	PAC-V OK	PAC-V NG
19		Measurable	13	13		13	0	-
		Non Measurable	6	/		4	0	-

Supplier | HMSI
Quality Head | In charge | Approved by | Checked by

To process-based, please write if there is a change in the new process (Use v for marking)

PQCS <<Base process flow>>
☐ Base Model
☐ Base Plant

PQCS <<New process flow>>
☐ New Model
☐ New Plant
☐ New Supplier

Process columns: RECEIVING INSPECTION | HOBBING | SHAVING | PRE WASHING | INDUCTION HARDENING | HARD TURNING | ROLL TESTING | CRACK DETECTION | VISUAL INSPECTION | FINAL INSPECTION

<<Change point note column>>
Detail of change point etc.

Mark in necessary item against above mentioned process
① No change from base - ●
② There is a change from base - ★

4M situation

Item	REC	HOB	SHAV	PRE W	IND H	HARD T	ROLL	CRACK	VIS	FINAL
Raw materials	●	●	●	●	●	●	●	●	●	●
Die Maintenance	-	-	-	-	-	-	-	-	-	-
Equipment	-	●	●	●	●	●	●	●	●	●
Jig and Fixture	-	●	●	●	●	★	●	●	●	●
Mfg. Tools	-	★	★	●	★	★	●	●	●	●
Insp. Tool	-	★	★	●	●	●	●	●	●	●
Operator training	★	★	★	★	★	★	★	★	★	●
PQCS	★	★	★	★	★	★	★	★	★	★
Work Std.	★	★	★	★	★	★	★	★	★	★
Check sheet	★	★	★	★	★	★	★	★	★	★

<<Part feature note column>>
Specific information about 4M situation
HOBBING -CUTTER CHANGE
SHAVING- TAIL STOCK & CUTTER CHANGE
HARD TURNING - LOCATOR CHANGE

Process Assurance Capability - Verification
(PAC-V) will be OK if -
1. Process Assurance (Type a, & b) result are OK for Critical items.
2. Critical items included in PQCS and Operation Std.
3. Operator aware about Critical item's importance.
Note : For any deviation / change request Supplier must inform Purchase and SQA.

Type a. Measurable items (Examples)
1) Variable Dimensions
2) Torques
3) Destructive Hardness tests
4) Weld penetration
5) Cross Section dimension for which part cut is must
6) Breaking toque / load etc.

Process Assurance Method (Measurable)
Measurable → Cp/Cpk ≥ 1.33 → Sample Inspection
Measurable → Cp/Cpk < 1.33 → 100% Inspection

Type b. Non Measurable Items (Examples)
1) Assembly (Coupler, Bullet terminal etc.)
2) Visual Inspection
3) Grease / Oil /Adhesive applications
4) Manufacturing process parameters
5) Specification test
6) Material
7) Salt Spray / CASS tests, Paint adhesion (100/100 etc.) Offline tests
8) Specification test (e.g - Durability/ Endurance tests. Destructive tests etc.)
9) Specification test (e.g - Durability/ Endurance tests. Destructive tests etc.)
[above Examples are case by case & may change as per Requirement]

Process Assurance Method (Non Measurable)
Non Measurable → 200% Check (Minimum Double check) or Triple Check → Sample Inspection

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No.	Critical item	Control value	Insp. Tool	Inspection process : ■	Measurable/ Non-Measurable	Cp/Cpk	No of inspection	Included In PQCS	Included in Ope. Std.	Operator Awareness	PAC-V	Remarks
10A	Tip correctionl (One center)	FFT : 5 ±5 μm	TOOTH PROFILE GEAR TESTER	— / Freq: 1/SETUP & TC/ FM/SHIFT ■ 5/LOT	Measurable	1.48	2	o	o	o	OK	
11	Tooth profile waviness I (One center)	ICW : 4μm MAX	TOOTH PROFILE GEAR TESTER	— / Freq: 1/SETUP & TC/ FM/SHIFT ■ 5/LOT	Measurable	1.41	2	o	o	o	OK	
11A	Tooth profile waviness I (One center)	ICW : 4μm MAX	TOOTH PROFILE GEAR TESTER	— / Freq: 1/SETUP & TC/ FM/SHIFT ■ 5/LOT	Measurable	1.38	2	o	o	o	OK	
12	Tooth trace Mending (One center)	FH : 0 ±5μm	TOOTH PROFILE GEAR TESTER	— / Freq: 1/SETUP & TC/ FM/SHIFT ■ 5/LOT	Measurable	1.41	2	o	o	o	OK	
12A	Tooth trace Mending (One center)	FH : 0 ±5μm	TOOTH PROFILE GEAR TESTER	— / Freq: 1/SETUP & TC/ FM/SHIFT ■ 5/LOT	Measurable	1.58	2	o	o	o	OK	
13	Crowning (One center)	CRN : 0 + 5 μm	TOOTH PROFILE GEAR TESTER	— / Freq: 1/SETUP & TC/ FM/SHIFT ■ 5/LOT	Measurable	1.39	2	o	o	o	OK	
13A	Crowning (One center)	CRN : 0 + 5 μm	TOOTH PROFILE GEAR TESTER	— / Freq: 1/SETUP & TC/ FM/SHIFT ■ 5/LOT	Measurable	1.37	2	o	o	o	OK	
14	Lead waviness (One center)	LCW : 4μm MAX	TOOTH PROFILE GEAR TESTER	— / Freq: 1/SETUP & TC/ FM/SHIFT ■ 5/LOT	Measurable	1.44	2	o	o	o	OK	
14A	Lead waviness (One center)	LCW : 4μm MAX	TOOTH PROFILE GEAR TESTER	— / Freq: 1/SETUP & TC/ FM/SHIFT ■ 5/LOT	Measurable	1.33	2	o	o	o	OK	
15	Confirmation gear appearance	No dent and scratch , on chip and tooth side	VISUAL	— / Freq: '1/SETUP & TC 100% ■ 5/LOT	NOn - Measurable	--	3	o	o	o	OK	
16	Confirmation gear appearance	歯先・歯すじへの返りバリについては製造条件最悪品をHMに提示し管理基準を整合のこと For the burr returned to the tooth tip, tooth tip, and tooth trace, the worst manufacturing condition product is presented to HM and the management standard is matched. That	VISUAL	— / Freq: '1/SETUP & TC 100% ■ 5/LOT	NOn - Measurable	--	3	0	0	0	OK	
17	Carburized area hardness	HRC 50~60	ROCKWELL HARDNESS TESTER	— / Freq: 4/SET UP 1/LOT ■ 1/LOT	Measurable	2.75	2	o	o	o	OK	DESTRUCTIVE ITEM
18	Effective hardening layer	Measure the hardness distribution with a micro Vickers hardness tester and check the distance from the surface of the hardened layer to the point of hardness HV 513.	MICRO VICKER	— / Freq: F/SHIFT ■ 1/LOT	NOn - Measurable	--	2	o	o	o	OK	DESTRUCTIVE ITEM
19	All surfes	Confirm that there is not a de-coal bed		— / Freq	NOn - Measurable	--						DESTRUCTIVE ITEM

07010-FRHO-F0 001

Cp/Cpk Backup (Do not disturb formula in Cell)

| | Auto calculated (Do not disturb formula) | | | | | | Supplier input area (Sample readings) - | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
Cpk	Cp	Max.	Min.	Aver.	Range	Std. Dev.	USL	LSL	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
4.07	4.11	6.580	3.655	6.310	2.925	0.507	12.500	0.000	6.548	6.358	6.349	6.359	6.315	6.385	6.348	6.349	6.456	6.540	6.350	6.540	6.580	6.358	6.340	6.359	6.436	6.456	6.458	6.547	6.358	3.655	6.359	6.358	6.350	6.348	6.398	6.359	6.358	6.325
3.46	3.58	7.980	5.348	6.461	2.632	0.582	12.500	0.000	6.364	6.145	6.459	6.548	5.978	5.348	6.348	6.247	5.896	6.548	5.980	5.484	6.598	6.548	6.589	7.016	6.487	6.359	7.025	5.687	6.245	6.587	7.659	5.978	6.458	7.289	7.980	6.358	6.354	7.265
1.97	2.00	4.160	2.360	3.199	1.800	0.526	6.300	0.000	2.580	2.390	3.150	2.480	3.360	2.790	4.120	2.980	2.360	3.220	2.870	3.240	3.560	2.980	3.350	2.980	3.150	3.220	4.120	4.080	2.840	3.640	2.980	2.680	2.890	3.220	3.650	2.890	4.160	4.050
1.47	2.68	23.018	23.013	23.015	0.005	0.001	23.021	23.000	23.014	23.014	23.016	23.014	23.013	23.015	23.016	23.014	23.015	23.018	23.018	23.016	23.015	23.014	23.017	23.016	23.016	23.015	23.018	23.015	23.016	23.014	23.015	23.015	23.014	23.016	23.015	23.014	23.014	23.015
1.43	1.82	30.486	30.479	30.482	0.007	0.002	30.490	30.470	30.481	30.482	30.480	30.481	30.479	30.483	30.484	30.481	30.482	30.479	30.481	30.480	30.485	30.482	30.482	30.481	30.482	30.482	30.480	30.485	30.484	30.483	30.485	30.485	30.486	30.482	30.482	30.481	30.482	30.482
2.74	2.81	3.689	2.314	3.076	1.375	0.374	6.300	0.000	2.659	2.987	3.265	3.568	3.543	3.568	3.265	2.987	2.845	2.476	2.568	2.659	2.655	2.689	3.255	2.314	2.590	2.958	3.215	3.110	3.254	2.987	3.260	3.250	2.987	3.560	3.548	3.256	3.300	3.689
1.50	2.41	4.698	3.250	4.330	1.448	0.436	6.300	0.000	3.987	4.568	4.265	3.897	3.483	3.568	3.678	3.789	3.250	3.654	4.689	4.578	4.258	4.659	4.657	4.569	4.568	4.658	4.587	4.598	4.568	4.568	4.659	4.459	4.569	4.578	4.698	4.578	4.568	4.698
#DIV/0!	#DIV/0!	0.000	0.000	#DIV/0!	0.000	#DIV/0!			—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
#DIV/0!	#DIV/0!	0.000	0.000	#DIV/0!	0.000	#DIV/0!			—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
1.25	1.460	9.500	4.800	7.730	4.700	1.142	12.0	2.0	8.7	7.4	8.1	6.7	8.1	8.6	7.9	7.8	8.9	5.5	9.2	6.1	7.6	7.5	8.3	8.2	8.1	8.4	7.6	7.6	4.8	5.5	8.5	6.1	9.5	8.1	7.9	8.6	8.9	7.7
1.16	1.422	9.500	6.000	7.930	3.500	1.172	12.0	2.0	8.3	8.2	8.1	8.4	7.6	7.6	9.5	9.5	8.5	6.1	9.5	8.1	7.9	8.6	8.9	7.7	8.9	8.9	8.3	6.2	6.1	6.0	7.7	8.9	6.1	8.9	6.0	6.2	9.5	7.7
1.06	1.330	2.800	0.700	1.597	2.100	0.501	4.0	0.0	2.6	1.9	1.3	1.5	0.9	1.6	0.8	1.8	1.6	1.6	0.9	1.5	1.8	1.7	1.7	1.2	1.5	1.6	1.5	1.3	2.4	1.8	0.7	1.6	2.6	1.4	2.8	1.3	1.4	1.6
1.25	1.439	2.800	1.000	1.733	1.800	0.463	4.0	0.0	2.800	2.200	1.700	1.400	1.800	2.400	1.000	1.300	1.400	1.100	1.400	1.800	1.500	2.600	1.400	2.200	1.800	1.600	1.300	2.200	2.200	1.300	2.200	1.400	1.800	1.700	1.100	1.600	1.600	2.200
1.34	1.443	7.600	2.500	4.650	5.100	1.155	10.0	0.0	4.500	3.800	4.800	3.800	4.100	4.600	5.200	5.000	4.300	4.100	5.000	4.700	5.400	5.600	4.600	6.300	7.600	7.400	2.800	4.100	3.400	4.200	5.400	4.700	3.500	4.600	5.800	4.500	2.500	3.200

Cp/Cpk Backup (Do not disturb formula in Cell)

Auto calculated (Do not disturb formula)							Supplier input area (Sample readings)																														
Cpk	Cp	Max.	Min.	Aver.	Range	Std. Dev.	USL	LSL	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
1.36	1.48	6.400	2.000	4.590	4.400	1.123	10.000	0.000	6.2	2.6	4.8	5.6	5.0	2.0	4.3	4.3	4.2	5.2	4.1	4.9	4.5	4.4	4.2	5.1	5.7	5.8	2.6	3.1	4.9	3.4	3.4	4.4	4.2	6.0	6.3	5.1	6.4	5.0
1.10	1.41	2.700	0.900	1.567	1.800	0.474	4.000	0.000	2.1	1.5	1.2	1.5	1.3	1.0	1.5	1.6	1.2	1.8	1.1	1.2	1.0	0.9	1.9	2.7	2.2	2.6	1.5	1.0	1.9	1.1	2.1	2.0	1.8	1.2	1.8	1.2	1.6	1.5
1.26	1.38	2.800	1.100	1.827	1.700	0.483	4.000	0.000	1.4	1.9	1.5	2.4	1.7	1.5	2.0	1.1	1.5	1.5	1.5	1.2	1.4	1.4	1.2	2.8	2.5	2.7	2.2	2.1	1.3	2.2	2.5	1.8	1.6	1.6	2.1	1.6	2.1	2.5
0.48	1.41	-0.200	-5.000	-3.307	4.800	1.181	5.000	-5.000	-4.2	-2.8	-4.7	-3.6	-3.6	-3.9	-4.2	-2.5	-2.8	-2.8	-3.4	-2.0	-3.9	-3.8	-2.3	-3.6	-3.8	-3.8	-3.3	-2.7	-1.1	-5.0	-5.0	-0.2	-2.0	-5.0	-1.8	-5.0	-3.8	-2.6
1.43	1.58	2.600	-1.600	0.453	4.200	1.057	5.000	-5.000	1.8	1.2	0.3	1.5	1.2	-0.3	0.0	1.2	0.4	1.4	0.1	1.8	0.2	0.4	2.6	0.4	-0.2	0.0	0.9	1.2	-1.0	-1.5	-1.4	-0.6	-1.6	-0.2	0.9	0.0	0.9	2.0
1.21	1.39	3.000	1.000	2.167	2.000	0.598	5.000	0.000	2.1	1.0	1.5	2.4	2.6	2.5	2.5	2.5	1.9	1.9	1.8	1.0	3.0	2.9	1.8	1.9	2.1	2.5	1.6	2.0	1.3	2.9	3.0	2.6	2.6	2.4	3.0	2.0	2.6	1.1
1.23	1.37	3.000	0.900	2.250	2.100	0.608	5.000	0.000	2.6	1.0	2.1	2.1	0.9	2.1	2.9	2.1	2.2	1.9	2.5	1.9	3.0	2.4	2.1	2.8	2.9	2.5	1.6	2.0	1.3	2.6	3.0	2.6	2.6	2.8	3.0	2.0	2.9	1.1
1.25	1.44	2.800	1.000	1.733	1.800	0.463	4.000	0.000	2.8	2.2	1.7	1.4	1.8	2.4	1.0	1.3	1.4	1.1	1.4	1.8	1.5	2.6	1.4	2.2	1.8	1.6	1.3	2.2	2.2	1.3	2.2	1.4	1.8	1.7	1.1	1.6	1.6	2.2
1.06	1.33	2.800	0.700	1.597	2.100	0.501	4.000	0.000	2.6	1.9	1.3	1.5	0.9	1.6	0.8	1.8	1.6	1.6	0.9	1.5	1.8	1.7	1.7	1.2	1.5	1.6	1.5	1.3	2.4	1.8	0.7	1.6	2.6	1.4	2.8	1.3	1.4	1.6
2.746	4.993	57.800	56.800	57.250	1.000	0.334	60.000	50.000	57.100	56.800	57.200	57.500	57.200	57.800	56.900	57.500																						
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