รายการอ้างอิง

ภาษาไทย

เทวินทร์ สิริโชคชัยกุล. ก้าวสู่สากลด้วย QS-9000. กรุงเทพฯ: บริษัทซีเอ็ดยูเคชั่นจำกัด, 2540.

ฮิโตชิ ดูเมะ. Mamagement by Quality.กรุงเทพฯ: สามาคมส่งเสริมเทคโนโลยี่ไทยญี่ปุ่น, 2538.

วีรพงษ์ เฉลิมจิระรัตน์. The Quality System Development Handbook..กรุงเทพฯ: สำนักพิมพ์ผู้จัดการ, 2540.

ยุทธพงษ์ ไกยวรรณ์. การบริหารและระบบการผลิตในงานอุตสาหกรรม.กรุงเทพฯ: สำนักพิมพ์ศูนย์สื่อเสริม,1998.

ภาษาอังกฤษ

Quality System 9000. Michigan USA: AUAG.Co ,1995.

Production Parts Approval Process. Michigan USA: AUAG.Co ,1995.

Failure Mode Effects Analysis. Michigan USA: AUAG.Co ,1995.

Measurement System Analysis. Michigan USA: AUAG.Co ,1995.

Statistical Process Control. Michigan USA: AUAG.Co ,1995.

Advanced Product Quality Planning and Control Plan. Michigan USA: AUAG.Co ,1995.

Quality System Assessment. Michigan USA: AUAG.Co ,1995.

ภาคผนวก ก
แบบฟอร์มที่ใช้ในกระบวนการ

ตารางระดับความต้องการของการยื่นเอกสาร (Submission Requirements Table)

ข้อกำหนด (Requirement)	ระดับการยื่นเสนอ (Submission Level)				
	1	2	3	4	5

โดยที่ (PPAP ,1995)

S หมายถึง การส่งให้ลูกค้าอนุมัติ และเก็บสำเนาไว้ ณ แหล่งผลิต
R หมายถึง การเก็บไว้ ณ. แหล่งผลิต เพื่อ "พร้อม" ส่งให้กรณีลูกค้าร้องขอ
** หมายถึง การส่งข้อมูลเพื่ออนุมัติขึ้นอยู่กับการร้องขอของลูกค้า

Part Name _____ Part Number _____

Safety and/or
Government Regulations Yes ☐ No ☐

Engineering Drawing Change Level _____ Date _____
Additional Engineering Changes _____ Date _____
Shown on Drawing No. _____ Purchase Order No. _____ Weight _____ kg
Checking Aid No. _____ Engineering Change Level _____ Date _____

Supplier Manufacturing Information

Submission Information
Dimensional ☐ Material/Func ☐ Appearance ☐

Supplier Name : Supplier Code :

CustomerName/Division : _____

Street Address :

Buyer/Buyer Code : _____

City/States/Postal Code :

Application : _____

Reason for Submission

- ☐ Initial Submission
- ☐ Engineering Change (S)
- ☐ Tooling : Transfer, Replacement, or Additional
- ☐ Correction of Discrepancy
- ☐ Other-please specify
- ☐ Change to Optional Construction/Material
- ☐ Sub-Supplier of Material Source Change
- ☐ Change in Part Processing
- ☐ Parts Produced at Additional Location

(PPAP , 1995)

รูปหัวข้อในการจัดทำใบรับรองคุณภาพ (Part Submission Warrant, PSW)

REQUESTED SUBMISSION LEVEL (Check one)

☐ Level 1-Warrant, Appearance Approval Report (for designated appearance item only)

☐ Level 2-Warrant, Parts, Drawings, Inspection Results, Laboratory and Function Results; Appearance Approval Report

☐ Level 3-At Customer Location-Warrant, Parts Drawings, Inspection Results, Laboratory and Function Results, Appearance Approval Report, Process Capability Results, Capability Study, Process Control Plan, Gage Study, FMEA

☐ Level 4-Per Level 3, but without Parts

☐ Level 5-At Supplier Location-Warrant, Parts, Drawings, Inspection Results, Laboratory and Function Results Appearance Approval Report, Process Capability Results, Capability Study, Process Control Plan, Gage Study, FMEA

☐ Level 6-see GSQM 160

SUBMISSION RESULTS

The result for ☐ Dimensional measurements ☐ Material and func tests ☐ Appearance ☐ Statistical process package

These results meet all drawitns and specification requirements ☐ YES ☐ NO If NO Explanation Required

DECLARATION

I affirm that the samples represented by this warrant are arepresentive of our parts and nave been made to the applicable customer drawings and specifications and are made from specified material on regular production tooling with no operations other than regular production process. I have noted any deviations from this declaration below.

EXPLANATION/COMMENTS:

Print Name: _____ Tittle: _____ Phone No: _____

Supplier Authorized Signature _____ Date _____

FOR CUSTOMER USE ONLY

☐ Approved ☐ Rejected ☐ Other

Customer Name Customer signature Date

รูป (ต่อ) หัวข้อในการจัดทำใบรับรองคุณภาพ (Part Submission Warrant, PSW) (PPAP , 1995)

Item :

Model Years(s)/Vehicle(s):

Core Team:

Process Responsibility:

Key Date:

FMEA Number:

Page:

Prepared By:

FMEA Date (Orig): (Rev.0)

Process Function / Requirements	Potential Failure Mode	Potential Effect(s) of Failure	S e v	Potential Cause(s)/ Mechanism(s) of Failure	O C C U R	Current Process Controls	D e t e c	R. P. N.	Recommended Action(s)	Action Results				
										Actions Taken	s e v	O c c	D e t	R. P. N.

(PPAP ,1995)

รูปการจัดทำลักษณะข้อบกพร่องและผลกระทบของกระบวนการ (PFMEA)

			Mar-01	Apr-01	May-01	Jun-01	Jul-01	Aug-01	Sep-01	Oct-01	Nov-01	Dec-01	REMARK
MAIN SCHDULE		IN CHAGE											
DOCUMENT										PDD = PRODUC DESING DEPARTMENT QA = QUALITY DEPARTMENT PE = PRODUCT ENGINEERING DEPARTMENT PRE = PRODUCTION ENGINEERING DEPARTMENT			
TOOLING & SAMPLE													

รูปแผนการเตรียมการพัฒนาชิ้นส่วน(แกนบังคับเลี้ยว) ของผู้ส่งมอบ

			Mar-01	Apr-01	May-01	Jun-01	Jul-01	Aug-01	Sep-01	Oct-01	Nov-01	Dec-01	REMARK
QUI & FAC											PDD = PRODUC DESING DEPARTMENT QA = QUALITY DEPARTMENT		
PRODUCT											PE = PRODUCT ENGINEERING DEPARTMENT PRE = PRODUCTION ENGINEERING DEPARTMEN		

รูป(ต่อ) แผนการเตรียมการพัฒนาชิ้นส่วน(แกนบังคับเลี้ยว) ของผู้ส่งมอบ

ตารางผลการตรวจสอบด้านมิติของชิ้นส่วนตัวอย่างแกนบังคับเลี้ยว (Inspection Data)

ผลการตรวจสอบด้านมิติ

(INSPECTION DATA SHEET)

Part No: Lot No: Lot Qty:

Part Name: Date: ☐ Mass Production

Drawing Rev: Inspected by: ☐ Pilot Part

☐ Prototype

ITEM	Check point	Gage No.	1	2	3	4	5	Avg.	Range	OK	NG

Lot Judgement : ☐ OK ☐ NOT OK

REPORTER	CHECKED	APPROVED

ตารางมาตราฐานการตรวจสอบ (INSPECTION STANDARD) ชิ้นส่วนตัวอย่างแกนบังคับเลี้ยว

				Nissan Part No. : 48500 2S400-M		**Supplier Part No. :** SLA046A		**Part Name :** STEERING LINKAGE	
Item No.	Characteristic Item	Specifications (Standard)	Rank	Sample size & Frequency		Measuring Instruments	Recording Method	Inspection Lacation	Notes
				In-Process	Off-Line				

ตารางผลการทดสอบความน่าเชื่อถือ (Relybility Test Results)

TEST ITEM		TEST RESULTS	TEST REQUIREMENTS	JUDGMENT

(NES , 2000)

ตารางการคำนวณค่าความสามารถของกระบวนการ Cp ,Cpk

Capability Study

Genarla Information		Results
Project Number :	Report No. :	
Part Name :	Date :	**Process Potential**
Part No.	Inspector :	Cp =
Process :	Location :	**Process Capability**
Characteristic :	Lot Code :	CpK =
Instrument :		

Specification

USL	=	Units mm	Nominal =	Units	mm
LSL	=	Units mm	Range =	Units	mm

SampleTest Results

	1~10	11~20	21~30	31~40	41~50	51~60	61~70	71~80	81~90	91~100
1										
2										
3										
4										
5										
6										
7										
8										
9										
10										
$\overline{X}$										

Capability Analysis

Mean :	Mean + 3s :	Cp :
Std :	Mean - 3s :	Cpl :
Minimum :		Cpu :
Maximum :	Mean + 4s :	
Range :	mean - 4s :	CpK :

ตารางการศึกษาความแปรผันในระบบการวัด (GR&R)

GAGE REPEATABILITY AND REPRODUCIBILITY ANALYSIS REPORT

GARE : ID.No. : MEASURING DATE :

PART NO. : PART NAME : MODEL :

SPEC :

CHARACTERISTIC : TOLERANCE :

Appraiser	Suriyothai # Production				Janya # QC				Sayan # QC				Part AVG.
sample #	1st Tral	2nd Trial	3rd Trial	Range	1st Tral	2nd Trial	3rd Trial	Range	1st Tral	2nd Trial	3rd Trial	Range	X_P
1													
2													
3													
4													
5													
6													
7													
8													
9													
10													
Totals													R_P
	$\overline{X}_A$		$\overline{R}_A$		$\overline{X}_B$		$\overline{R}_B$		$\overline{X}_C$		$\overline{R}_C$		

R_A	R_B	R_C	Sum	$\overline{R}$

# Trial	2	3
D_4	3.27	2.58

Max $\overline{X}$	Min $\overline{X}$	$\overline{X}$ diff

MEESUREMENT UNIT ANALYSIS

% TOLERANCE ANALYSIS

Repeatability - Equipment Variation (E.V.)

(4) E.V. = $(\overline{R}) \times (K_1)$

=

# Trial	2	3
K_1	4.56	3.05

% E.V. = 100[(E.V.) / (T.V.)]

=

Reproducibility -- Appraiser Variation (A.V.)

(5) A.V. = $([(\overline{X}_{diff}) \times (K_2^2)]^2 - [(E.V.)^2 / (nxr)])^{1/2}$

=

#Operator	2	3
K_2	3.65	2.7

n = number of parts

r = number of trials

% A.V. = 100[(A.V.) / (T.V')]

=

Repeatability and reproducibility (R&R)

(6) R&R = $([E.V.]^2 + [A.V.]^2)^{1/2}$

=

% R&R = 100 [(R&R) / (T.V.)]

=

Part Variation (P.V>)

(7) P.V. = $(R_p) \times (K_3)$

=

Parts	2	3	4	5	6	7	8	9	10
K_3	3.65	2.70	2.30	2.08	1.93	1.82	1.74	1.67	1.62

Total Variation (T.V.)

(8) T.V. = $[(R\&R^2) + (P.V.^2)]^{1/2}$

=

% P.V. = 100 [(P.V.) / (T.V.)]

=

ตารางการคำนวณค่าความแปรผันในระบบการวัด

Study Date :

Gage ID :

Gage Desc :

Appraisers : Trials :

Study Type:

Company Part No.:

Part No.:

Part Desc:

Characteristic:

Specification Limits :

6 Sigma Proc Var:

R bar A = : X bar A = :

R bar B = : X bar B = :

R bar c = : X bar C = :

R bar = : X bar Diff = :

R_P = Tol =

Measurement Unit Analysie :	% Total Variation (TV):	% Tolerance :
Repeatability - Equipment Variation (EV) : EV : = R bar x K1 : =	% EV : = 100[EV / TV]	% EV : = 100 [EV / Tol]
Reproducibility - Appreiser Variation (AV) : AV: = $\sqrt{[(\text{X bar Diff} \times K_2^2)^2 - (EV^2 / n \times r)]}$: =	% EV : = 100[TV / TV]	% EV : = 100 [tV / Tol]
Repeatability & Reproducibility (R&R) : R&R: = $\sqrt{(EV^2 + AV^2)}$ =	% R&R: = 100 [R&R / TV]	% R&R: = 100 [R&R / Tol]
Part Variation (PV) : PV : = $R_P \times K_3$	% PV: = 100 [PV / TV]:	% PV: = 100 [PV / Tol]:
Total Variation (TV) : TV: = $\sqrt{(R\&R^2 + PV^2)}$ =	If the 6 sigma process variation is known, then TV = 5.15 [6 sigma process variation] / 6.00 and PV = SQRT[(TV^2) - $(R\&R)^2$].	

Trials	K1
2	4.56
3	3.05

Appraisers	2	3
K2	3.65	2.70

Note: If a negative value is calculated under the square root sign, AV defaults to zero.

n = number of parts
r = number of trials

Parts	K3
2	3.65
3	2.70
4	2.30
5	2.08
6	1.93
7	1.82
8	1.74
9	1.67
10	1.62

ตารางแผนควบคุมคุณภาพ

PRODUCTION CONTROL PLAN

SUPPLIER NAME ____________________ DATE ISSUED:______________

PLANT LOCATION ____________________

SUPPLIER CODE

PART NAME	PART RANK	REVISION NO.	REVISION DATE	REVISION Description	SNA APPROVAL
	A				QA MANAGER
PART NUMBER & ECN LEVEL					QA MANAGER
MODEL YEAR & VEHICLE PROGRAM					

PROCESS FLOW: OP No.	PROCESS FLOW: PROCESS NAME	PROCESS FLOW: MACHINE, DEVICE. JIG, TOOLS FOR MANUFACTURING	CONTROL POINTS: PROCESS CHARACTERISTICS	CONTROL POINTS: PRODUCT CHARACTERISTICS	RANK (A, AR, B,C)	ON SNA DWG.	METHODS: PERSON IN CHARGE

(PPAP , 1995)

ต่อ

QC: Quality Staff OP: Operator MA: Maintenance

SUPPLIER APPROVAL

DATE	QA MANAGER DATE
DATE	QA ENGINEER DATE

PROCESS/ PRODUCT SPECIFICATION	SAMPLE SIZE/ FREQUENCY	MEASURING INSTRUMENT METHODS	RECORD (ANALYSIS METHODS)	NOTES (RELATED STANDARD ETX…) and/or REACTION PLAN	

(PPAP , 1995)

ตารางกระบวนการวิเคราะห์ลักษณะข้อบกพร่องและผลกระทบ (FMEA)

Item :
Model Years(s)/Vechicle(s) :
Core Team :

Process Responsibility :
Key Date :

Process Function Requirements	Potential Failure Mode	Potential Effect(s) of Failure	Sev	Class	Potential Cause(s)/ Mechanism(s) of Failure	Occur

(FMEA ,1995)

FMEA NUMBER :

MEP 500-001
Prepared By :
FMEA Date (Orig) :

Current Process Controls	Detec	R.P.N.	Recommended Action(s)	Responsibility & Target Completion Date	Action Results				
					Action Results Taken	Sev	Occ	Det	R.P.N.

(FMEA ,1995)

ภาคผนวก ข

แผนควบคุมกระบวนการผลิต

Control Plan

PRODUCTION CONTROL PLAN

SUPPLIER NAME (1) Steering & Suspension Co., Ltd. DATE ISSUED: September 18, 2000
PLANT LOCATION Eastern Seaboard Industrial Estate
SUPPLIER CODE

PART NAME (4) / STEERING LINKAGE (2)	PART RANK	REVISION NO.	DATE	Description	SNA APPROVAL
	A	0	18/9/00	Initial Release	QA MANAGER
PART NUMBER & ECN LEVEL 48500 2S420-M Rev. 02		1	9/7/01	Drawing Change to Rev.02	QA MANAGER
MODEL YEAR & VEHICLE PROGRAM (3) D22				(10) (1)	(1)

PROCESS FLOW			CONTROL POINTS		RANK	ON	METHODS
(5) OP No.	(6) PROCESS NAME	MACHINE, DEVICE. JIG, TOOLS FOR MANUFACTURING	(8) PROCESS CHARACTERISTICS	(9) PRODUCT CHARACTERISTICS	(A, AR, B,C)	SNA DWG.	PERSON IN CHARGE
	Receiving Inspection-All Components	n/a (7)	n/a	See drawings	B, C	N	QC
OP No. 10	Machining-Face & Dreamer Machin	Vertical Machining Center-M0020 & M0021&m0022	See machine set-up instruction and preventive maintenance plan		C	N	OP/MA
				Inner hole pitch	B	N	OP/QC
				Taper fitness 1/8	C	N	
				Taper datum Dai. L	C	N	
				Bore Diameter	C	N	
OP No. 20	Machining-Face & Taper Machining	Vertical Machining Cener-M0020 & M0021 & M0022	See machine set-up instruction and preventive maintenance plan		C	N	OP/MA
				Distance (A-A, B-B)	B	N	OP/QC
				Distance (A-A, B-B)	B	N	
				Hole pitch(A-A, B-B SLA045A Hole pitch(A-A) for SLA046A Hole pitch(B-B) for SLA046A	B	N	
				Taper 7 deg	C	N	
				Spinning rib	C	N	
				spinned angle	C	N	
				Disc spring depth	C	N	
				Bore diameter	C	N	
				Bore diameter	C	N	

(PPAP , 1995)

QC: Quality Staff OP: Operator MA: Maintenance

SUPPLIER APPROVAL

DATE	QA MANAGER Terrapin rojkunarak	DATE	
DATE	QA ENGINEER Narisa Buaban	DATE	

(13) PROCESS/ PRODUCT SPECIFICATION	(14) SAMPLE SIZE/ FREQUENCY	(15) MEASURING INSTRUMENT METHODS	(16) RECORD (ANALYSIS METHODS)	NOTES (RELATED STANDARD ETX...) and/or REACTION PLAN	
See receiving insp. Standard	See receiving insp. Standard	Various Gages	Receiving Inspection Standard	If out of spec., contact supervisor	
See M/C set-up instruction, daily M/C check sheet, PM plan	See M/C set-up instruction, daily M/C check sheet, PM plan	See M/C set-up instruction, daily M/C check sheet, PM plan	Daily M/C check sheet, PM plan, Operator insp. data sheet		If gages are damaged or not available, standard gages can be used such as Venire Calipers, Height Gage, CMM, etc. Quality must be Informed prior to use.
570 +/- 0.5	1/180	CMM	Operator insp. data sheet		
Blue contact >= 75% (Contacting all around at major Dai. Is a must)	first piece	Taper gage			
18.7+/-0.25(dia.16)	first piece	GC-00004			
14.2+/-0.1	1/90	Plain Plug Gage			
See M/C set-up instruction, daily M/C check sheet, PM plan	See M/C set-up instruction, daily M/C check sheet, PM plan	See M/C set-up instruction, daily M/C check sheet, PM plan	Daily M/C check sheet, PM plan, Operator insp. data sheet		
13.6+/-0.5	1/180	CMM	Operator insp. data sheet		
102+/-0.5 106+/-0.5 102+/-0.5					
Min 30%	first piece	Taper Gage			
0.8-1.3	1/90	Thickness Gage			
6-7 Degree	first piece	Profile Projector			
7.9+0.1/0	first piece	GD-00003			
26+0.2/0	first piece	V.Caliper			
30+0.13/0	first piece	V.Caliper			

(PPAP , 1995)

PROCESS FLOW			CONTROL POINTS		RANK (A, AR, B,C)	ON SNA DWG.	PERSON IN CHARGE
	PROCESS NAME	MACHINE, DEVICE. JIG, TOOLS FOR MANUFACTURING	PROCESS CHARACTERISTICS	PRODUCT CHARACTERISTICS			
OP No. 30	Rod Relay - Machining-Face & OD Milling	Vertical Machining Center-M0020 & M0021&m0022	See machine set-up instruction and preventive maintenance plan		C	N	OP/MA
				Diameter B-B	C	N	OP/QC
				Height B-B	C	N	
				Diameter B-B	C	N	
				Diameter B-B	C	N	
				Thickness A-A	B	N	
				Dust cove O.D A-A	B	N	
				window diameter A-A	A	N	
				Pararell	C	N	
				window angle A-A	A	N	
				Bore diameter B-B	C	N	
				Thickness B-B	C	N	
				Bottom Thickness A-A	A	N	
				Thickness A-A	C	N	
OP No. 40	Rod Relay - Machining-Face Nacgububg	Vertical Machining Center-M0020/ M0021/M0022	See machine set-up instruction and preventive maintenance plan		C	N	OP/MA
				Taper Depth	C	N	OP/QC
				Spot Diameter	C	N	
				Runout	C	N	
				Appearance	A	N	
OP No. 50	Bush Assembly - Bushing & Sizing	M0041	See daily M/C check sheet and regular M/C check sheet		C	N	OP/MA
				Appearance	B	N	OP

(PPAP , 1995)

METHODS					
PROCESS/ PRODUCT SPECIFICATION	SAMPLE SIZE/ FREQUENCY	MEASURING INSTRUMENT METHODS	RECORD (ANALYSIS METHODS)	NOTES (RELATED STANDARD ETX...) and/or REACTION PLAN	
See M/C set-up instruction, daily M/C check sheet, PM plan	See M/C set-up instruction, daily M/C check sheet, PM plan	See M/C set-up instruction, daily M/C check sheet, PM plan	Daily M/C check sheet, PM plan, Operator insp. data sheet	If out of spec., contact supervisor	If gages are damaged or not available, standard gages can be used such as Venire Calipers, Height Gage, CMM, etc. Quality must be Informed prior to use.
32+/-0.3	first piece	V.Caliper	Operator insp. data sheet		
7.9+0.1/0	1/90 pcs.	GC-00003			
26+0.2/0	1/90 pcs.	01-10 KOGA 196			
30+0.13/0	first piece	01-10 KOGA 195			
9 +/-0.2	1/90 pcs.	BSP-017-0001			
35.18 +/-0.1	1/90 pcs.	BSP-018-0001			
26 +0.6/0	1/90 pcs.	BSP-019-0001			
0.3 MAX	first piece	CMM			
28 +0/-1 degree	first piece	CMM			
20 +0.033/0	1/90 pcs.	BPL-109-0001			
25.8 +/-0.2	1/90 pcs.	GD-00002			
3 +/- 0.15	1/30 pcs.	GB-00004			
23 +0/-0.5	1/90 pcs.	GD-00008			
See M/C set-up instruction, daily M/C check sheet, PM plan	See M/C set-up instruction, daily M/C check sheet, PM plan	See M/C set-up instruction, daily M/C check sheet, PM plan	Daily M/C check sheet, PM plan, Operator insp. data sheet		
18+/-0.25	1/90 pcs.	BPL-035-0001	Operator insp. data sheet		
25+3/0	first piece	V.Caliper			
0.15 Max (Dia.20)	first piece	00-12 KOGA F187			
No crack and detriment	All	Visual			
See daily and regular M/C check sheets	See daily and regular M/C check sheets	See daily and regular M/C check sheets	Daily M/C check and regular M/C check sheets		
no crack after bushing and sizing	All	Viaual	n/a		

(PPAP , 1995)

PROCESS FLOW			CONTROL POINTS		RANK (A, AR, B,C)	ON SNA DWG.	PERSON IN CHARGE
OP No.	PROCESS NAME	MACHINE, DEVICE. JIG, TOOLS FOR MANUFACTURING	PROCESS CHARACTERISTICS	PROCESS CHARACTERISTICS			
OP No. 60	Spinning sub-assembly (Idler pin, Disc spring and cap-Idler Arm Side)	Pre-loading Machine-M0058	See daily M/C check sheet and regular M/C check sheet		C	N	OP/MA
				Type of Idler pin	A	Y	OP
				Grease weight (TSG(	B	N	OP
OP No. 70	Assembly - Spinning (Ider arm side)	Spinning Machine-M0094/ (M0059)	See Daily M/C check sheet and regular M/C check sheet		C	N	OP/MA
			Clamping pressure		C	N	OP
			clamping time		C	N	
			Spinning pressure		C	N	
			Spinning time		C	N	
				Spinning Diameter	B	N	
				Rotating Torque (Right after assembly)	B	N	
			Appearance of spinning area		A	N	
OP No. 80	Tie Rod Ass'y (IBJ, OBJ)	M0098		Distance between in out B/Js	C	Y	
				Tightening torque fo nuts	C	Y	
OP No. 90	Assembly - Pre-loading (Pitman Arm Side)	Pre-loading Machine-M0093/M005(	See daily M/C check sheet and regular M/C check sheet		C	N	OP/MA
			Pre-loading pressure		C	N	OP
			Pre-loading time		C	N	
				Grease weight (TSG(	B	N	
				Type of ball stud	A	Y	
OP No. 100	Assemble-Spinning (Pitman arm side)	Spinning Machine M0094/ M0069	See daily M/C check sheet and regular M/C check sheet		C	N	OP/MA
			Clamping pressure		C	N	OP
			Clamping time		C	N	
			Spinning pressure		C	N	
			Spinning time		C	N	
				Spinning Diameter	B	N	
				Plug Quantity	A	N	
				Plug Breaking Torque	B	N	
				Oscillating Angle (X 8	A	Y	
				Starting Torque	B	N	
				Rotating Torque (Right after	B	N	
				Appearance of spinning area	A	Y	

(PPAP , 1995)

METHODS					
PROCESS/ PRODUCT SPECIFICATION	SAMPLE SIZE/ FREQUENCY	MEASURING INSTRUMENT METHODS	RECORD (ANALYSIS METHODS)	NOTES (RELATED STANDARD ETX...) and/or REACTION PLAN	
See M/C set-up instruction, daily M/C check sheet, PM plan	See M/C set-up instruction, daily M/C check sheet, PM plan	See M/C set-up instruction, daily M/C check sheet, PM plan	Daily M/C check she, PM plan, Operator insp. data sheet		
BLI 117A	All	Visual	n/a		
0.2 ~ 0.5 g.	2 Pcs. / first	Scale Weight	Operator check sheet		
See daily and regular M/C check sheets	See daily and regular M/C check sheets	See daily and regular M/C check sheets	Daily M/C check shee, PM plan, Operator insp. data sheet		
2.1 ~ 2.35 kgf/cm^2	Set-up	Pressure gage	Operator check sheet		
0.5 ~ 0.8 sec.	Set-up	Timer			
2.00~2.40 kgf/cm^2	Set-up	Pressure gage			
1.8~2.0 sec.	Set-up	Timer			
26.5 ~ 27.1 mm.	2 Pcs (first/last)	V.caliper			
4~27 kgf.cm	2 Pcs (first/last)	Torque Wrench			
No crash	All	Visual			
53.9+/-3 mm.	1 pc (first/Last)	V.caliper			
30 Kgf.cm	All	Torque wrench			
See daily and regular M/C check sheets	See daily and regular M/C check sheets	See daily and regular M/C check sheets	Daily M/C check shee, PM plan, Operator insp. data sheet		
8 ~ 10 Kgf/cm^2	Set-up	Pressure gage	Operator check sheet		
0.8~1.5 sec.	Set-up	Timer			
0.3~0.7 g.	2 pcs - first	Scale Weight			
BLI 135A	All	Visual	n/a		
See daily and regular M/C check sheets	See daily and regular M/C check sheets	See daily and regular M/C check sheets	Operator check sheet		
1.3 ~ 2.1 Kgf/cm^2	Set-up	Pressure gage			
0.5 ~ 0.7 sec.	Set-up	Timer			
1.3 ~ 2.4 Kgf/cm^2	Set-up	Pressure gage			
1.2 ~ 1.6 sec.	Set-up	Timer			
26.0 ~ 26.7 mm.	2 Pcs (first/Last)	V.caliper			
1 plug	All	Mistake proofing	n/a		
120 Kgf.cm (MIN)	1 psc (first/Last	SPF	Operation check sheet		
9.5 Degree MIN	2 psc (first/Last	SPF			
180 Kgf.cm (MAX)	2 psc (first/Last	SPF			
5~17 Kgf.cm	2 psc (first/Last	Torque Wrench			
No crack	All	Visual			

(PPAP , 1995)

PROCESS FLOW			CONTROL POINTS		RANK	ON	
OP No.	PROCESS NAME	MACHINE, DEVICE. JIG, TOOLS FOR MANUFACTURING	PROCESS CHARACTERISTICS	PROCESS CHARACTERISTICS	(A, AR, B,C)	SNA DWG.	PERSON IN CHARGE
OP No. 110	Assembly -Dust Cover (Push on)	Dust Cover Assemble Machine-M0095	See daily M/C check sheet and regular M/C check sheet		C	N	OP/MA
				Grease weight (TSG003A)	B	N	OP
				Type of dust cover	A	N	OP
OP No. 120	Assembly-Seal Dust Assembly (Idler arm side)	Seal Dust Assemble Machine-M0095/ M0080/0095 (M0059)	See Daily M/C check sheet and regular M/C check sheet		C	N	OP/MA
				Appearance	A	N	OP
				Grease weight (TSG(	B	N	OP
				Type of dust cover	A	N	OP
OP No. 130	Assembly-Tie-Rod & Nut Sub-Assembly	Tie-Rod Sub-Assemble Machine-M0062 3/M0064	See daily M/C check sheet and regular M/C check sheet		C	N	OP/MA
				Tie-Rod Distance	C	N	OP
OP No. 140	Inspection-Dock Au	Visual	n/a	completion of link as	A	Y	QC

(PPAP , 1995)

METHODS					
PROCESS/ PRODUCT SPECIFICATION	SAMPLE SIZE/ FREQUENCY	MEASURING INSTRUMENT METHODS	RECORD (ANALYSIS METHODS)	NOTES (RELATED STANDARD ETX...) and/or REACTION PLAN	
See daily and regula M/C check sheets	See daily and regular M/C check sheets	See daily and regular M/C check sheets	Daily M/C check and regular M/C check sheets	If out of spec., contact supervisor	If gages are damaged or not available, standard gages can be used such as Venier Calipers, Height Gage, CMM, etc. Quality must be Informed prior to use.
4 ~ 6 g.	1 pc/first	Scale Weight	Operation check sheet		
BDC 186A	All	Visual	n/a		
See daily and regular M/C check sheets	See daily and regular M/C check sheets	See daily and regular M/C check sheets	Daily M/C check and regular M/C check sheets	↑	↑
No tear	All	Visual	Operator check sheet		
0.2 ~0.5 g.	1 pc/first	Weight Scale	↑		
BDC 187A	All	Visual	n/a		
See daily and regular M/C check sheets	See daily and regular M/C check sheets	See daily and regular M/C check sheets	Daily M/C check and regular M/C check sheets		
35 MM-MIN	Set-up	V.caliper	Operator check sheet		
As per final inspection	All	Visual	Dock audit inspection reports (QCF-040)	↑	↑

(PPAP , 1995)

ภาคผนวก ค
การวิเคราะห์ข้อบกพร่องและผลกระทบของกระบวนการ

ตารางที่ ค - 1 กระบวนการวิเคราะห์ลักษณะข้อบกพร่องและผลกระทบ (FMEA)

Item : Center Link / CTL049A & 050A (2)
Model Years(s)/Vechicle(s) : 2001 / D22 (5)
Core Team : P.R. Dhamodhran, Seksan, Damiel, Surasa, Narisa (8)

Process Responsibility : TRE (3)
Key Date : 28.9.2001 (6)

(9) Process Function Requirements	(10) Potential Failure Mode	(11) Potential Effect(s) of Failure	(12) Sev	(13) Class	(14) Potential Cause(s)/ Mechanism(s) of Failure	(15) Occur
Receiving inspection	Cannot indicate the NC part	Lost time due to dowintime & sorting Cost of lost time	5		Not sampling size Not qualified inspcetor Improtance gauge	6 2 4
Load Part	Loading into the Incorrect Fixture	Accident Tool Breakage Fixture damage Ineffective clamping	6		Operator mistake	1
	Wrong Loading in the same Fixture	Accident Tool break Fixture damage	6		Operator mistake	1
	Pad not Contacting the Locating Surface	Inconsistent taper hole depth Part moving during cutting	4		Incorrect forgings	2
Center Distance 570±0.5	Incorrect	Tie wear	4	B	Program error Tool damage	1
Taper Hole Depth Inner Pad Dia 16(18.7+/-0.3)	Deep	Loose ball stud	4	C	Taper reamer broken Offset error Face milling cutter broken Worn tools	2
	Shallow	Less seal peformance	2			

(FMEA ,1995)

FMEA NUMBER :
MEP 500-001 (1)
Prepared By : Daniel Eyring (4)
FMEA Date (Orig) : (Rev. 2) 23.10.2001 (7)

(16) Current Process Controls	(17) Det c	(18) R.P.N.	(19) Recommended Action(s)	(20) Responsibility & Target Completion Date	Action Results (22)				
					Action Results (21) Taken	Sev	Occ	Det	R.P.N.
Skip lot Accept MSA, training MSA, Guage design	3 3 4	90 30 80	None None None						
Mistake proofing system	2	12							
Mistake proofing system	2	12							
Gages	4	32							
Proven CNC Program Presets & Gages	3	12							
Tool change cycles Presets & Gages	1	8 4							

(FMEA ,1995)

(ต่อ) กระบวนการวิเคราะห์ลักษณะข้อบกพร่องและผลกระทบ (FMEA)

Process Function Requirements	Potential Failure Mode	Potential Effect(s) of Failure	Sev	Class	Potential Cause(s)/ Mechanism(s) of Failure	Occur
Contact Cercentage Minimum 75%	Less contact	Less durability	8	A	Tool incorrect angle Broken too	1
Cener Distance 02±0.5/2.8±0.5	Incorrect	Interference	4	B	Offset error Improper location Locating pin damage	1
Center Distance 3.6 ±0.5/2.8±0.5	Incorrect	Interference	4	B	Offset error Improper location Locating pin damage	1
Torque Depth 0.955~21.971	More than Spec.	High torque	2	C	Broken / worn out tool Program error Offset error	2
	Less than Spec.	Less rigidity Less durability	4			
Rollover Thickness 0.8~1.3	More Thick	Less seal performance Less durability & rigidity	3	C	Offset error Worn / broken tool	2
	Thin	Rollover strength less	2	C		
bowl Depth 5.91 ±0.2	Incorrect	Variation in ball joint performance	3	C	Offset error Worn / broken tools Improper location	2
Contact Percentage Minimum 30%	Less contact	Less durability	2	C	High chuck pressures Incorrect CNC program Broken tool	2
Articulation Windo Dai 26 + 0.6/0 end Angle 28^0 0/-1	More	Less pull out strength Less durability	8	A	Offset error Worn / broken tools Improper location Took incorrect	2
	Less	Ball joint movement restriction	8	A		
Bottom Thickness 3 ±0.15	Thin Bottom	Less pull out strength	8	A	offset error program error Broken tool No contact on locator	2
	Thick Bottom	Less oscillation angle	8	A		
Bush Dust Cover Sia 35.18 ± 0.1	Incorrect	Reduction in seal Performance	5	B	offset error Worn / broken tool Improper Tools	1
Step Width ± 0.2	Less	Reduction in seal performance	4	B	Offset error Worn / broken tool	2
Bush diameter 0+0.033	Less Dia	less durability Part damage	5	C	Offset error Improper tool Worn / broken tool	2
	More Dia	less durability More noise	5	C		
Pre Dia 6+0.2/-0	Incorrect	Less durable	3	C	Offset error Improper set up Worn / broken tool	2
	More	Less rollover strength	3	C	Offset error	2
Pre Dia 6+0.13/-0	Less	assemble not possible	1	C	Improper set up Worn / broken tools	

(FMEA ,1995)

Current Process Controls	Det ec	R.P.N.	Recommended Action(s)	Responsibility & Target Completion Date	Action Results					
					Action Results Taken	Sev	Occ	Det	R.P.N.	
Qualified tooling Tool change cycles. Periodic checks by operator	2	16	Periodic checks by operator							
Presets & Gages Proven location Visual check	4	16								
Presets & Gages Proven location Visual check	4	16								
Tool change cycles Qualified tooling Periodic checks by operator.	3	12 24								
Presets & gages Tool change cycles	4	24 16								
Presets & gages Tool change cycles Auto location	3	18 18								
Established chuck pressure Proven CNC program Tool change cycles.	3	12								
Presets & gages Tool change cycles Auto location Qualified tool	2	32 32	Periodic checks by operator							
Tool change cycles Qualified tooling Proven CNC program Presets & gages	2	32 32	Periodic checks by operator							
Tool change cycles Qualified tooling Tool change cycles	2	10								
Presets & gages Tool change cycles	3	24								
Presets & gages Proven set up Tool change cycles	3	30 30								
Presets & gages proven setup Tool change cycles Presets & gages	4 4	24 24								
proven setup Tool change cycles		8								

(FMEA ,1995)

(ต่อ) กระบวนการวิเคราะห์ลักษณะข้อบกพร่องและผลกระทบ (FMEA)

Process Function Requirements	Potential Failure Mode	Potential Effect(s) of Failure	Sev	Class	Potential Cause(s)/ Mechanism(s) of Failure	Occur
Rollover Dia. 32	More	Less seal performance Less durability	4	C	Offset error Worn / broken tools chuck pressure	2
	Less	Less rigidity less rollover strength	4	C		
Step width	Less	High torque	5	C	Offset error Worn / broken tools	1
Total Width 15.8 ±0.20	Incorrect	Seal performance of Dustseal not proper	3	C	Improper location Offset error Worn / broken tools	1
#op40 Depth 18.0±0.25	More	not able to mount a split pin	1	C	Improper location Offset error Worn / broken tools	1
	Less	Loosen of ball stud	4	C	Improper location Offset error Worn / broken tools	1
Run out 0.15 Max (o 20)	More	Nut not tighten properly	3	C	Improper location Offset error Worn / broken tools	1
Component Inspec ree from crack/def	crack/defect	Less durability	8	A	- Supplier defects - Process defects	1

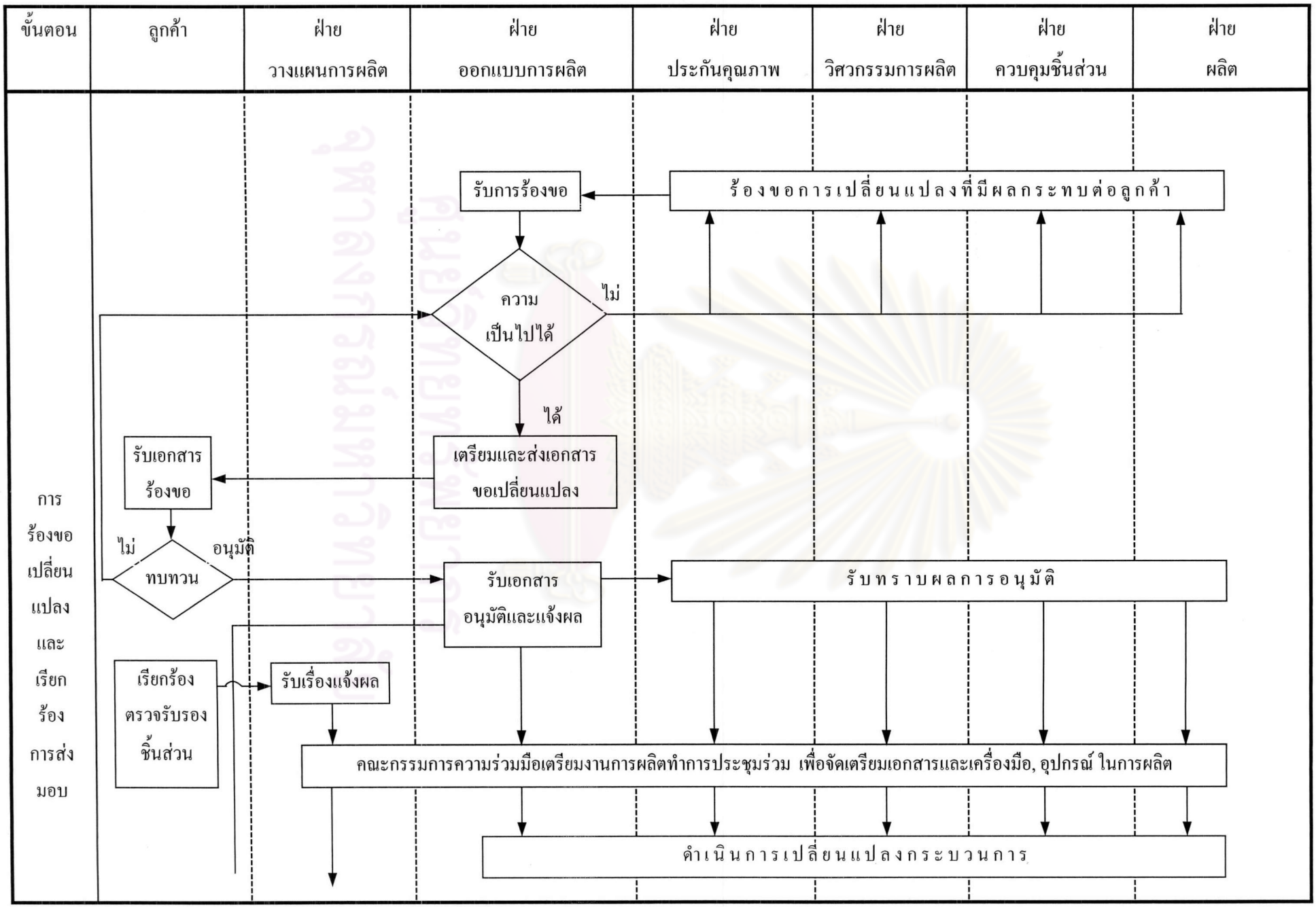
(FMEA ,1995)

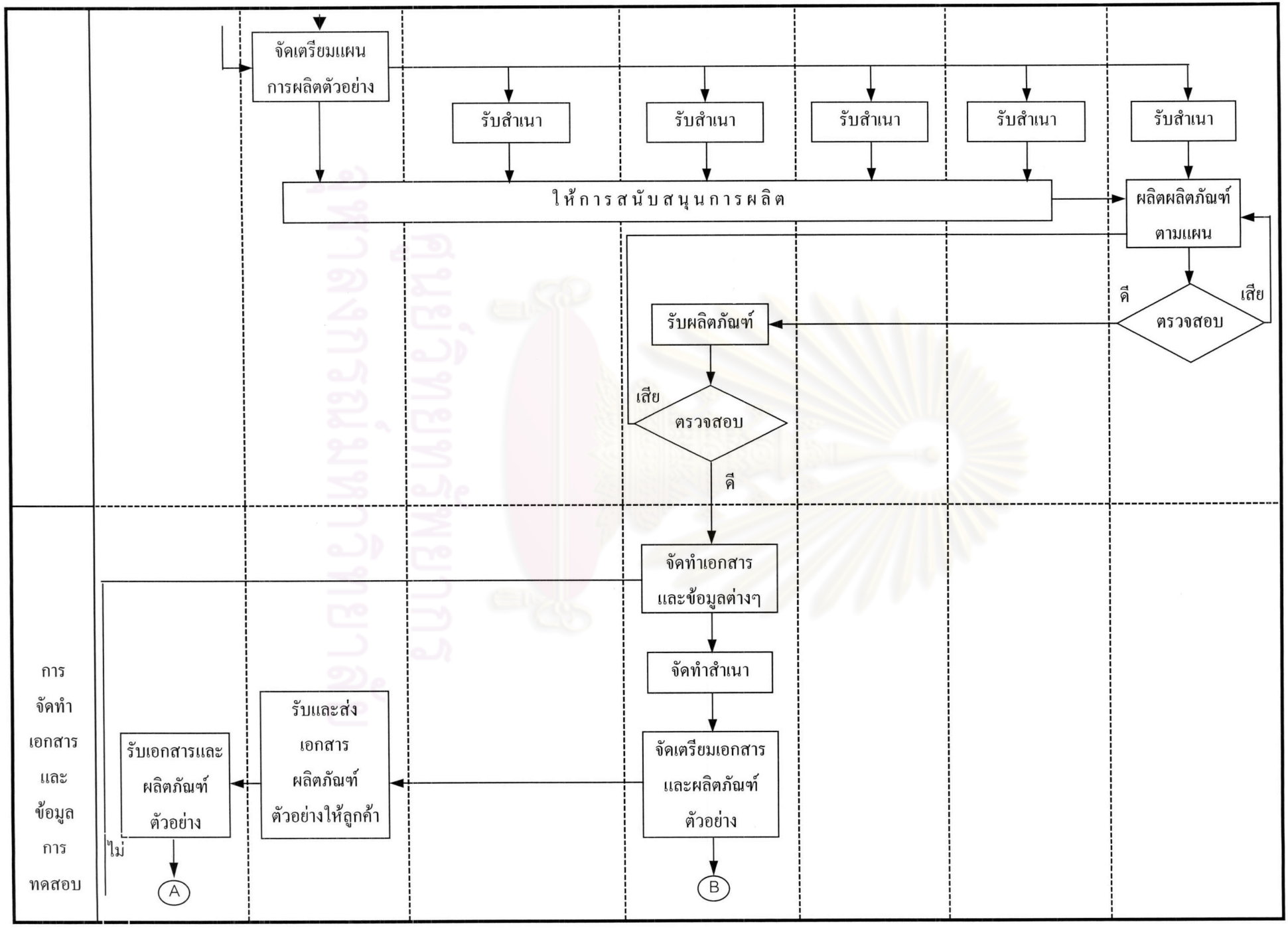
Current Process Controls	Det c	R.P.N.	Recommended Action(s)	Responsibility & Target Completion Date	Action Results				
					Action Results Taken	Sev	Occ	Det	R.P.N.
Presets & gages Tool change cycles Established chute pressure	4	32							
Presets & gages Tool change cycles	4	20							
Auto pull down location Presets & gages Tool change cycles	1	12							
Auto pull down location Presets & gages Tool change cycles	2	2							
Auto pull down location Presets & gages Tool change cycles	2	8							
Auto pull down location Presets & gages Tool change cycles	2	6							
100% visual	1	84	none						

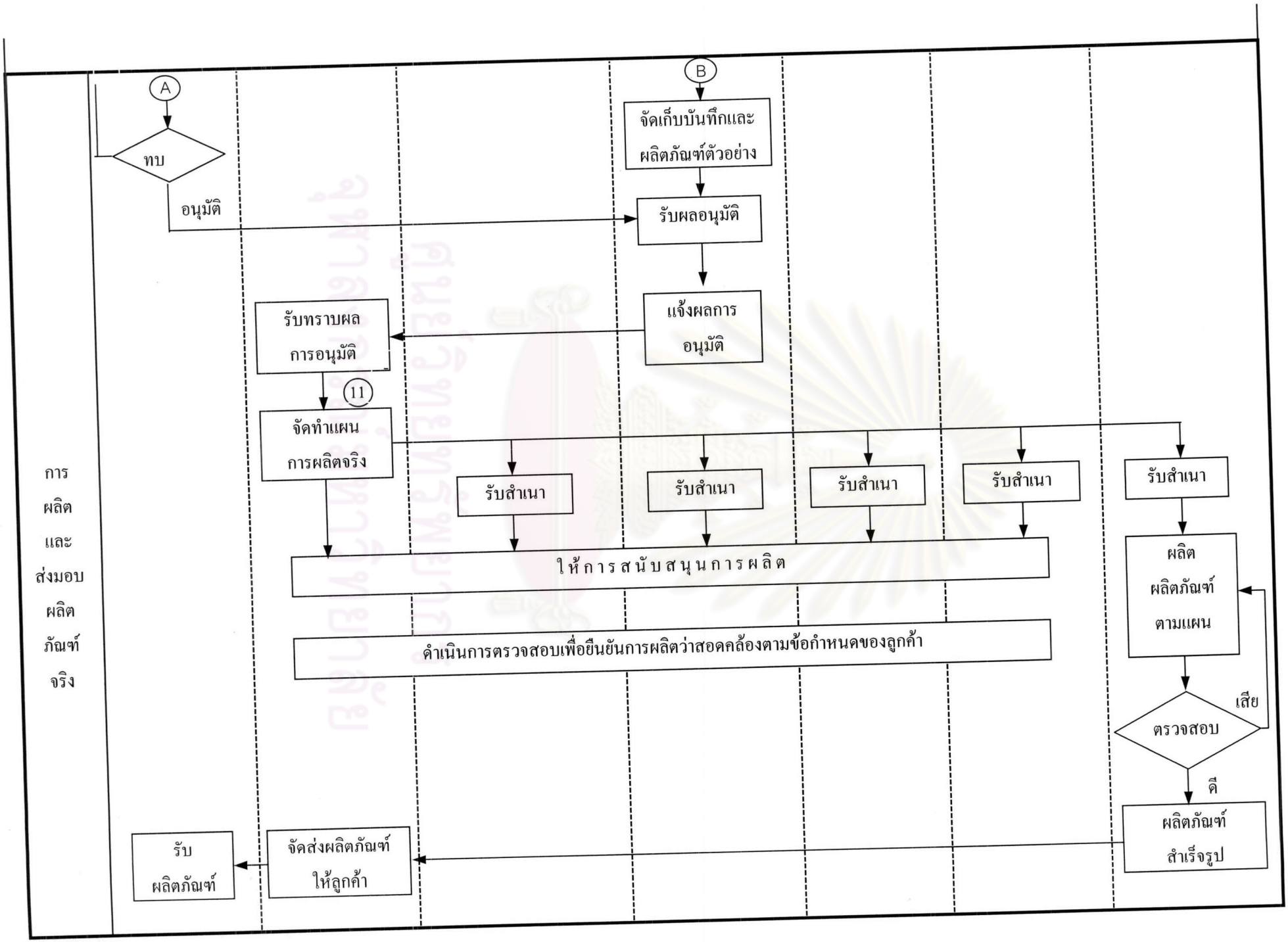
(FMEA ,1995)

ภาคผนวก ง
กระบวนการอนุมัติชิ้นส่วนก่อนการผลิตจริง

กระบวนการอนุมัติชิ้นส่วนการผลิต




จัดเตรียมแผน
การผลิตตัวอย่าง
รับสำเนา
รับสำเนา
รับสำเนา
รับสำเนา
รับสำเนา
ให้การสนับสนุนการผลิต
ผลิตผลิตภัณฑ์
ตามแผน
ดี
เสีย
ตรวจสอบ
รับผลิตภัณฑ์
เสีย
ตรวจสอบ
ดี
จัดทำเอกสาร
และข้อมูลต่างๆ
จัดทำสำเนา
จัดเตรียมเอกสาร
และผลิตภัณฑ์
ตัวอย่าง
B
รับและส่ง
เอกสาร
ผลิตภัณฑ์
ตัวอย่างให้ลูกค้า
รับเอกสารและ
ผลิตภัณฑ์
ตัวอย่าง
ไม่
A
การ
จัดทำ
เอกสาร
และ
ข้อมูล
การ
ทดสอบ


การผลิตและส่งมอบผลิตภัณฑ์จริง
A
ทบ
อนุมัติ
B
จัดเก็บบันทึกและผลิตภัณฑ์ตัวอย่าง
รับผลอนุมัติ
แจ้งผลการอนุมัติ
รับทราบผลการอนุมัติ
11
จัดทำแผนการผลิตจริง
รับสำเนา
รับสำเนา
รับสำเนา
รับสำเนา
รับสำเนา
ให้การสนับสนุนการผลิต
ดำเนินการตรวจสอบเพื่อยืนยันการผลิตว่าสอดคล้องตามข้อกำหนดของลูกค้า
ผลิตผลิตภัณฑ์ตามแผน
ตรวจสอบ
เสีย
ดี
ผลิตภัณฑ์สำเร็จรูป
จัดส่งผลิตภัณฑ์ให้ลูกค้า
รับผลิตภัณฑ์

ประวัติผู้เขียน

นาย สหพล บูรสุขสวัสดิ์ เกิดวันที่ 5 ตุลาคม 2514 ที่อำเภอภาษีเจริญ จังหวัดกรุงเทพมหานคร สำเร็จการศึกษาปริญญาตรีวิศวกรรมศาสตร บัณฑิต ภาควิชา วิศวกรรมอุตสาหการ มหาวิทยาลัยธรรมศาสตร ในปีการศึกษา 2538 แล้วเข้าศึกษาต่อในหลักสูตรวิศวกรรมศาสตรมหาบัณฑิต สาขาวิศวกรรมอุตสาหการ ที่จุฬาลงกรณ์มหาวิทยาลัย เมื่อ พ.ศ. 2542 ปัจจุบันทำงานอยู่ที่บริษัทนิสสันออโตโมบิล จำกัด จังหวัดสมุทรปราการ