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March 17, 2008

VIA FEDERAL EXPRESS

Jeffrey L. Quandt, Chief
Vehicle Control Division
Office of Defects Investigation
U.S. Department of Transportation
National Highway Traffic Safety Administration
1200 New Jersey Avenue, S.E.
Washington D.C. 20590

OFFICE OF DEFECTS
INVESTIGATION

Re: **Preliminary Evaluation (PE07-062)**
Peer Vehicle Data: MY 2002 Kia Sportage; Front Suspension Upper Ball Joint

Dear Mr. Quandt:

This letter is submitted in response to your letter dated February 5, 2008 (Reference NVS-213swmc/PE07-062). That letter requested peer vehicle data concerning the upper ball joint assemblies in the 2002-2003 model year Kia Sportages to assist with an investigation of alleged front suspension upper ball joint separations in certain model 2002-2003 Jeep Liberty four-wheel drive vehicles.

Although HATCI is an organization independent of both Kia Motors Corporation ("KMC") and Kia Motors America, Inc. ("KMA"), it has been designated by those organizations to act as their communication liaison with the National Highway Traffic Safety Administration ("NHTSA"). This response is submitted to NHTSA by HATCI in that limited role.

Please note that the Kia Sportage was not produced for the 2003 model year. Thus, the response below is limited to the 2002 model year Kia Sportage. For clarity purposes, Kia does not formally use the phrase "upper ball joint assemblies" to describe the subject component. For example, Kia's Parts Catalog refers to the subject component as the "upper arm assembly" and all searches for responsive information have been conducted in relation to that part, as well as references to "ball joints".

REQUEST NO. 1:

State, by model, drivetrain and model year, the number of the subject vehicles Kia has manufactured for sale or lease in the United States. Separately, for each subject vehicle manufactured to date by Kia, state the following:

- a. Vehicle identification number (VIN);
- b. Model;

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Jeffrey L. Quandt, Chief

Office of Defects Investigation

Page 2 of 7

- c. Drivetrain (e.g., 2-wheel drive, 4-wheel drive);
- d. Model Year;
- e. Date of manufacture;
- f. Date warranty coverage commenced; and
- g. The State in the United States where the vehicle was originally sold or leased (or delivered for sale or lease.)

Provide the table in Microsoft Access 2000, or a compatible format, entitled "PRODUCTION DATA." See Enclosure 1, Data Collection Disc, for a pre-formatted table which provides further details regarding this submission.

RESPONSE TO REQUEST NO. 1:

The total number of 2002 Kia Sportage manufactured for sale in the United States was 46,887. A listing of all 2002 Kia Sportage vehicles is provided on a Data Collection Disc under the category "PRODUCTION DATA" and is submitted contemporaneously with this response.

REQUEST NO. 2:

State the number of each of the following, received by Kia, or of which Kia is other aware, which relate to, or may relate to, the subject condition in the subject vehicles:

- a. Consumer complaints, including those from fleet operations;
- b. Field reports, including dealer field reports;
- c. Reports involving a crash, injury, or fatality, based on claims against the manufacturer involving a death or injury, notices received by the manufacturer alleging or providing that a death or injury was caused by a possible defect in a subject vehicle, property damage claims, consumer complaints, or field reports;
- d. Property damage claims; and
- e. Third-party arbitration proceedings where Kia is or was a party to the arbitration; and
- f. Lawsuits, both pending and closed, in which Kia is or was a defendant or codefendant.

For subparts "a" through "d" state the total number of each item (e.g., consumer complaints, field reports, etc.) separately. Multiple incidents involving the same vehicle are to be counted separately.

Multiple reports of the same incident are also to be counted separately (i.e., a consumer complaint and a field report involving the same incident in which a crash occurred are to be counted as a crash report, a field report and a consumer complaint).

In addition, for items, "c" through "f," provide a summary description of the alleged problem and causal and contributing factors and Kia's assessment of the problem, with a summary the significant underlying facts and evidence. For items "e" and "f," identify the parties to the action, as well as the caption, court, docket number, and the date on which the complaint or other document initiating the action was filed.

Hyundai-Kia America Technical Center, Inc

Jeffrey L. Quandt, Chief

Office of Defects Investigation

Page 3 of 7

RESPONSE TO REQUEST NO. 2:

Pursuant to your letter, we searched for all upper arm assembly separation incidents and found the following:

- a. Consumer Complaints—0
- b. Field Reports/Technical Assistance Reports—0
- c. Reports involving crash, injury or fatality alleging death or injury caused by possible defect—0
- d. Property Damage Claims—0
- e. Third Party Arbitrations—0
- f. Lawsuits—0

REQUEST NO. 3:

Separately, for each item (complaint, report, claim, notice or matter) within the scope of your response to Request No. 2, state the following information:

- a. Kia's file number or other identifier used;
- b. The category of the item, as identified in Request No. 2 (i.e., consumer complaint, field report, etc.);
- c. Vehicle owner or fleet name (and fleet contact person), address, and telephone number;
- d. Vehicle's VIN;
- e. Vehicle's model and model year;
- f. Vehicle's mileage at time of the incident;
- g. Incident date;
- h. Report or claim date;
- i. Whether a crash is alleged;
- j. Whether property damage is alleged;
- k. Number of alleged injuries, if any; and
- l. Number of alleged fatalities, if any.

Provide this information in Microsoft Access 2000, or a compatible format, entitled 'REQUEST NUMBER TWO DATA.' See Enclosure 1, Data Collection Disc, for a pre-formatted table which provides further details regarding this submission.

Hyundai-Kia America Technical Center, Inc

Jeffrey L. Quandt, Chief

Office of Defects Investigation

Page 4 of 7

RESPONSE TO REQUEST NO. 3:

Not applicable. See response to Request No. 2.

REQUEST NO. 4:

Produce copies of all documents related to each item within the scope of Request No. 2. Organize the documents separately by category (i.e., consumer complaints, field reports, etc.) and describe the method Kia used for organizing the documents.

RESPONSE TO REQUEST NO. 4:

Not applicable. See response to Request No. 2.

REQUEST NO. 5:

State, by model, drivetrain and model year, total counts for all of the following categories of claims, collectively, that have been paid by Kia to date that relate to repair or replacement of the subject components, or the associated control arm assembly if the subject component cannot be serviced separately, in the subject vehicles: warranty claims; extended warranty claims; claims for good will services that were provided; field, zone, or similar adjustments and reimbursements; and warranty claims or repairs made in accordance with a procedure specified in a technical service bulletin or customer satisfaction campaign.

Separately, for each such claim, state the following information:

- a. Kia's claim number;
- b. Vehicle owner or fleet name (and fleet contact person) and telephone number;
- c. VIN;
- d. Repair date;
- e. Vehicle mileage at time of repair;
- f. Repairing dealer's or facility's name, telephone number, city and state or ZIP code;
- g. Labor operation number;
- h. Problem code;
- i. Replacement part number(s) and description(s);
- j. Whether there was a claim for towing within 3-days of the subject component repair claim;
- k. Whether there was a claim for replacement of any of the following components at the same side as the subject component involved in the claim (i.e., right-front or left-front) within 3-days of the subject component repair claim;
 - i) Steering knuckle;
 - ii) Brake rotor; or
 - iii) Half-shaft.
- l. Concern stated by customer; and
- m. Comment, if any, by dealer/technician relating to claim and/or repair.

Hyundai-Kia America Technical Center, Inc

Jeffrey L. Quandt, Chief

Office of Defects Investigation

Page 5 of 7

Provide this information in Microsoft Access 2000, or a compatible format, entitled "WARRANTY DATA." See Enclosure 1, Data Collection Disc, for a pre-formatted table which provides further details regarding this submission.

RESPONSE TO REQUEST NO. 5:

None. See response to Request No. 6.

REQUEST NO. 6:

Describe in detail the search criteria used by Kia to identify the claims identified in response to Request No. 5, including the labor operations, problem codes, part numbers and any other pertinent parameters used. Provide a list of all labor operations, labor operation descriptions, problem codes, and problem code descriptions applicable to the subject condition in the subject vehicles. State, by make and model year, the terms of the new vehicle warranty coverage offered by Kia on the subject vehicles (i.e., the number of months and mileage for which coverage is provided and the vehicle systems that are covered.) Describe any extended warranty coverage option(s) that Kia offered for the subject vehicles and state by option, model, and model year, the number of vehicles that are covered under each such extended warranty.

RESPONSE TO REQUEST NO. 6:

Kia searched all upper arm assembly replacement warranty claims, including goodwill, involving part number OK011 34 200A and found 55 claims. Kia screened these claims to determine whether any of them indicated a separation in the "Tech Notes" and/or whether there was a towing claim identified since the vehicle would have needed to be towed if there had been a upper arm assembly separation. None of the 55 upper arm assembly replacement warranty claims had towing claims attached nor did any of the tech comments identify that any vehicle was towed or had a separated control arm or ball joint.

In addition, none of the 55 warranty claims involved the replacement of the steering knuckle, brake rotor or half-shaft within 3 days of the upper arm assembly replacement claim as requested in Request Number 5.

REQUEST NO. 7:

Provide the following parts or information regarding the subject components:

- a. Quarter sectioned exemplar samples of each design version of the subject components;
- b. A diagram of the front suspension at static curb weight with longitudinal, lateral and vertical loads of the upper and lower ball joints;
- c. State the design life of the subject components;
- d. State the end-play specification, or other criteria, for replacement of the subject components;

Hyundai-Kia America Technical Center, Inc

Jeffrey L. Quandt, Chief
Office of Defects Investigation
Page 6 of 7

- e. Describe all engineering standards and specifications regarding the durability of the subject components; and
- f. Provide copies of all results from tests described in 7e.

RESPONSE TO REQUEST NO. 7:

- a. Kia will send a complete part (OK011 34 200A) via Federal Express under separate cover.
- b. Kia is providing a design drawing of the upper arm assembly, including front, side and top views. Kia is also providing a copy of the pages from the 2002 Kia Sportage Parts Catalog applicable to the upper arm assembly. Kia has no drawing showing load distribution at curb weight. **See Tab 1.**
- c. Kia does not use the phrase "design life" in relation to this part. The entire vehicle was subjected to a 200,000 km durability test and no exceptions were noted for this part in such vehicle testing.
- d. Attached are the end-travel test reports. In addition, attached are pages from the 2002 Sportage Service Manual including the maintenance schedule, inspection instruction and torque specification of the "upper control arm ball joint link-to-steering knuckle bolt." **See Tab 2 and 3.**
- e. Attached is a general translation of the Korean summary of the 18 tests conducted by Central Corporation. **See Tab 4.** This summary chart contains the engineering standards and specifications for testing of the upper arm assembly. It also contains a summary of performance, strength, durability and seal testing applicable to the upper arm assembly. The original test reports, where available, from which the summary information was obtained, are also attached. **See Tab 5.** Kia is also providing a Korean version of the testing which contains photographs and graphs of the testing information identified in the original test reports. The title page and table of contents have been translated for your convenience. **See Tab 6.**
- f. See Tabs 4, 5 & 6.

REQUEST NO. 8:

State the number of each of the following that Kia has sold that may be used in the subject vehicles by component name, part number (both service and engineering/production), model and model year of the vehicle in which it is used and month/year of sale (*including the cut-off date for sales, if applicable*):

- a. Subject component;
- b. Any kits that have been released, or developed, by Kia for use in service repairs to the subject component/assembly.

Hyundai-Kia America Technical Center, Inc

Jeffrey L. Quandt, Chief
Office of Defects Investigation
Page 7 of 7

For each component part number, provide the supplier's name, address and appropriate point of contact (name, title, and telephone number). Also identify by make, model and model year, any other vehicles of which Kia is aware that contain the identical component, whether installed in production or in service, and state the applicable dates of production or service usage.

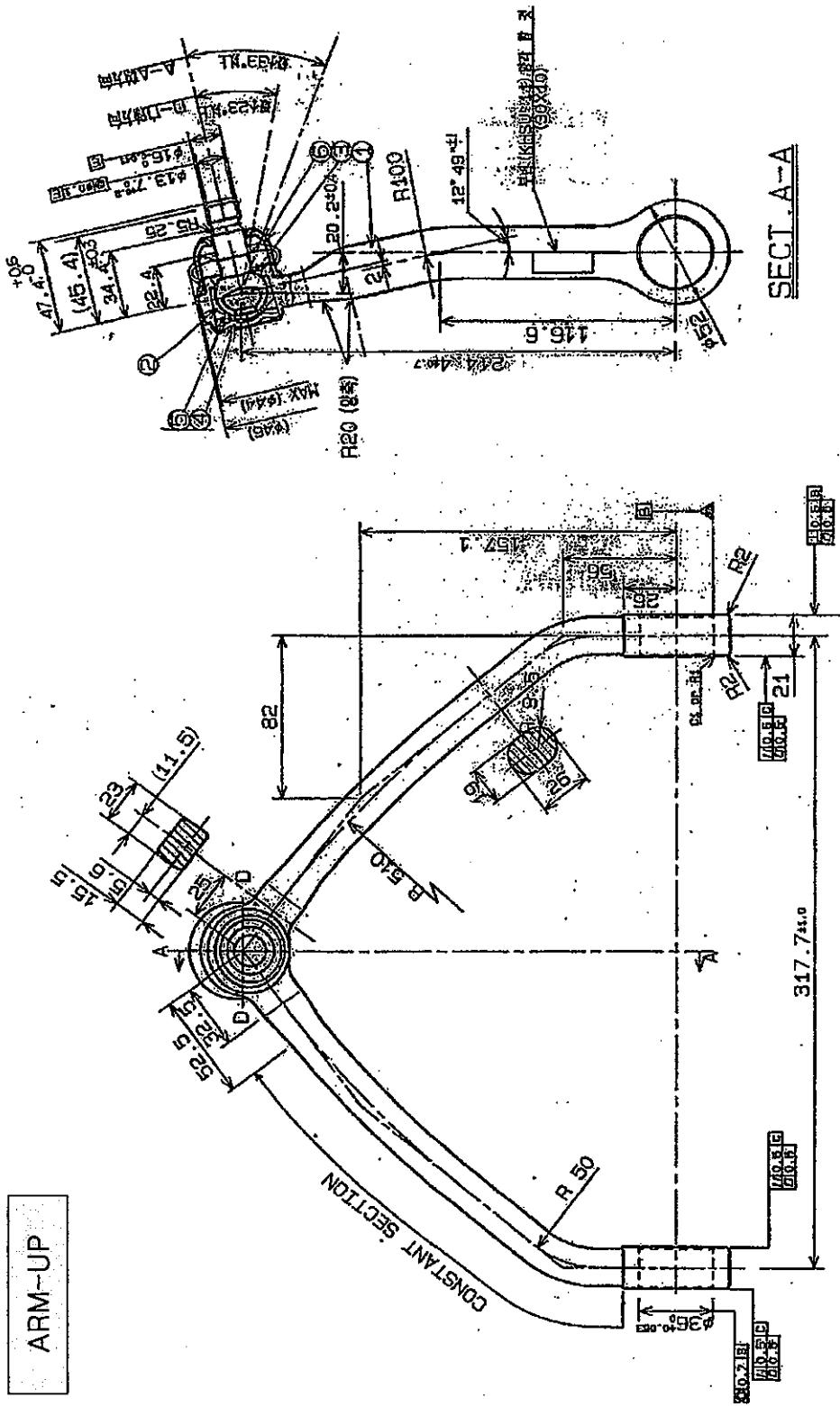
RESPONSE TO REQUEST NO. 8:

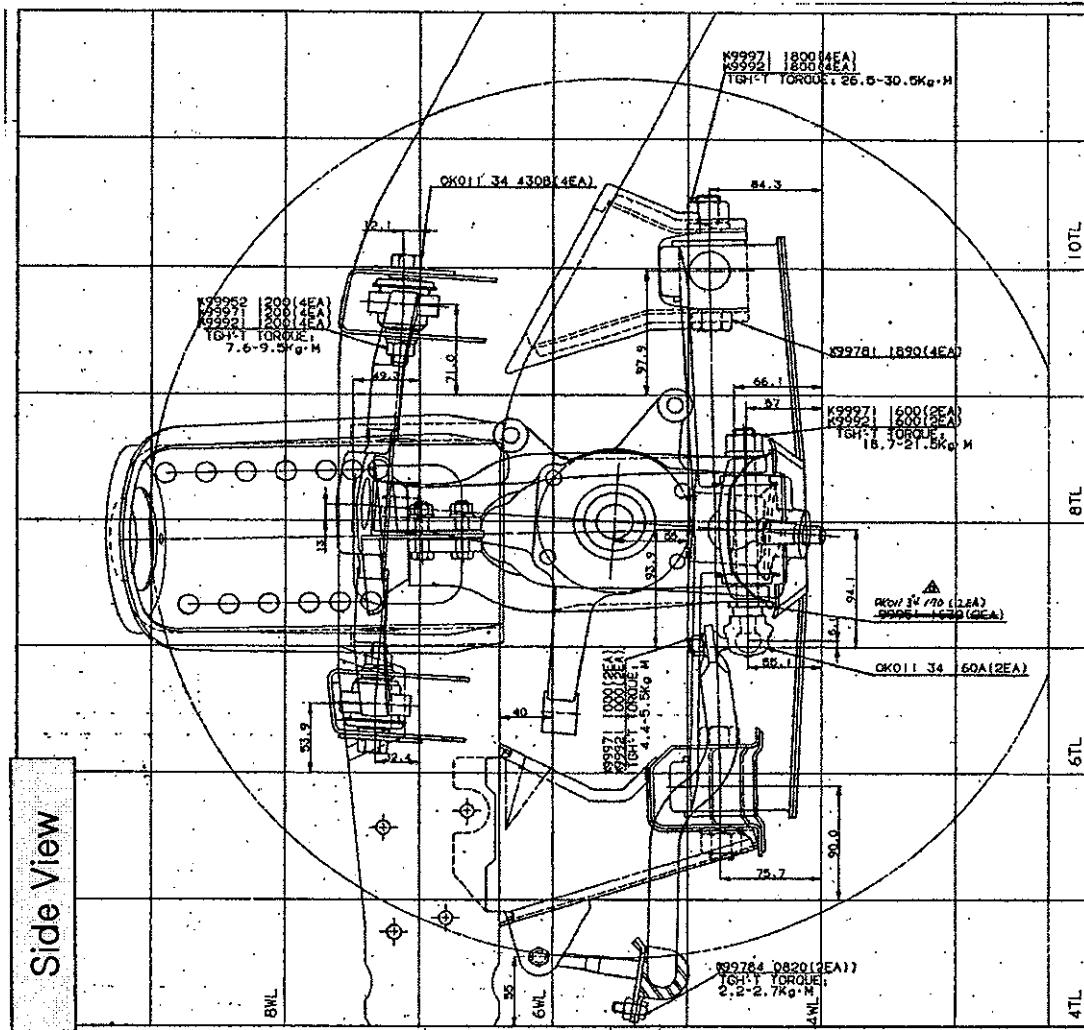
A chart identifying part sales is attached. See **Tab 7**. The chart contains part sales data from June 1, 2001 thru February 15, 2008 since June 1, 2001 is the first distribution date for the 2002 Kia Sportage. However, this new part was also interchangeable with all prior Sportages for the 1995-2001 model years since the upper control arm dimensions remained the same. Thus, Kia discontinued the sale of prior versions of the upper arm assembly and part number OK011 34 200A became the standard replacement part for the 1995-2002 Sportage vehicles.

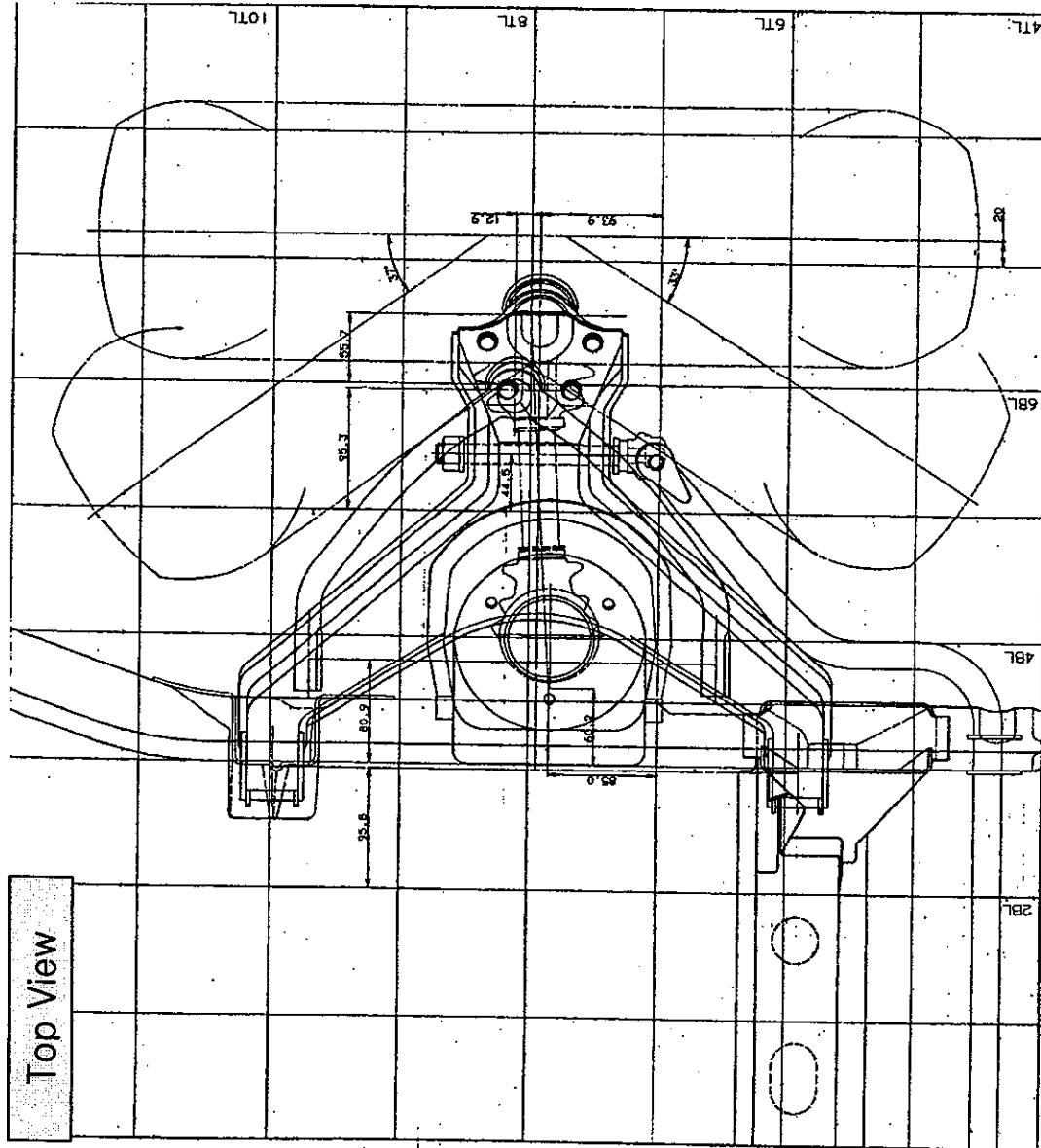
The supplier of the upper control arm (part number OK011 34 200A) is Central Corporation and the point of contact is Hyunsik Kim (Deputy General Manager). Mr. Kim can be reached at 54, Sungsan-dong, Changwon-city, Kyungnam, Korea (82)55-278-0291.

Sincerely,

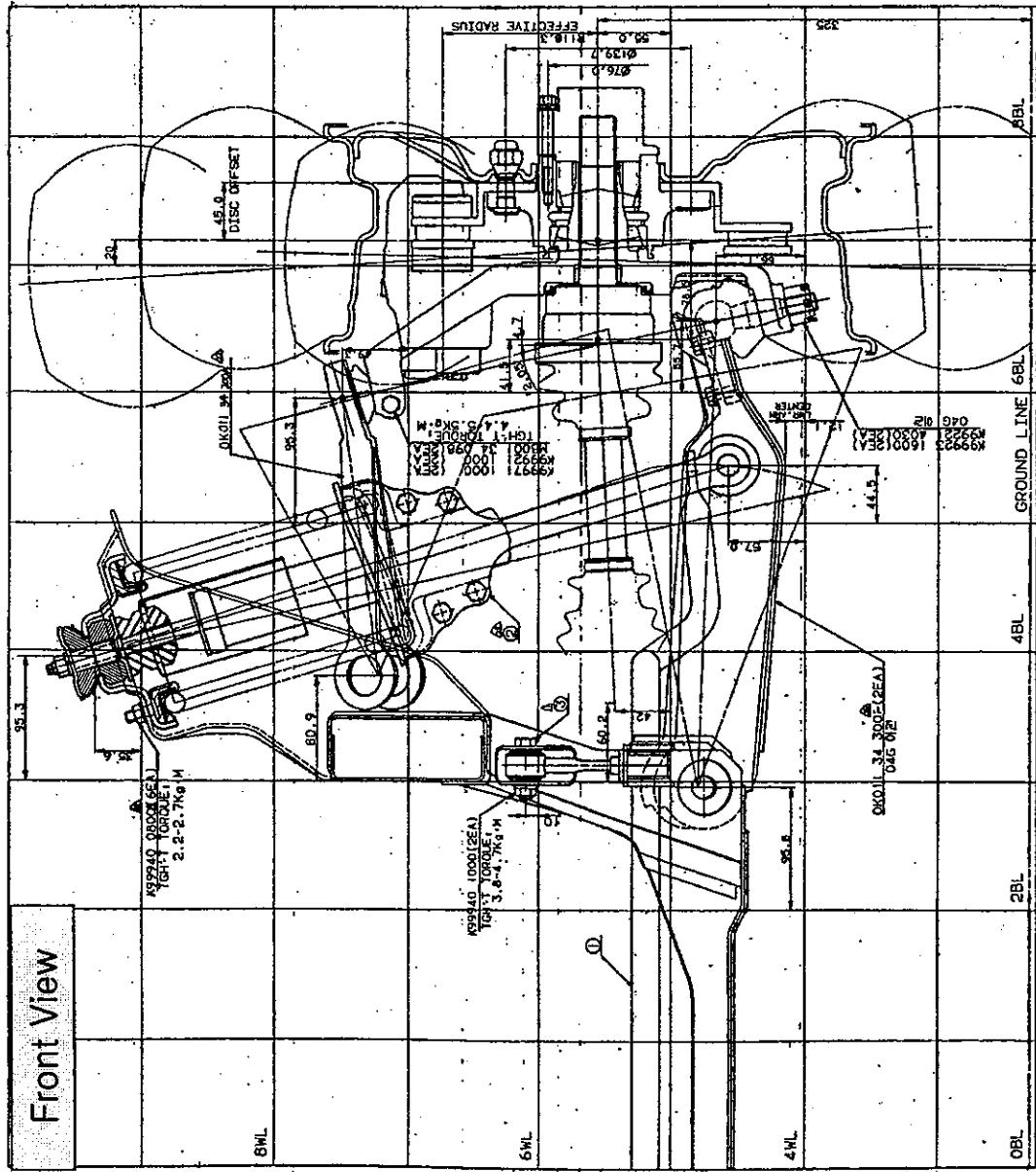
Robert Babcock
Senior Manager, Regulation and Certification Department

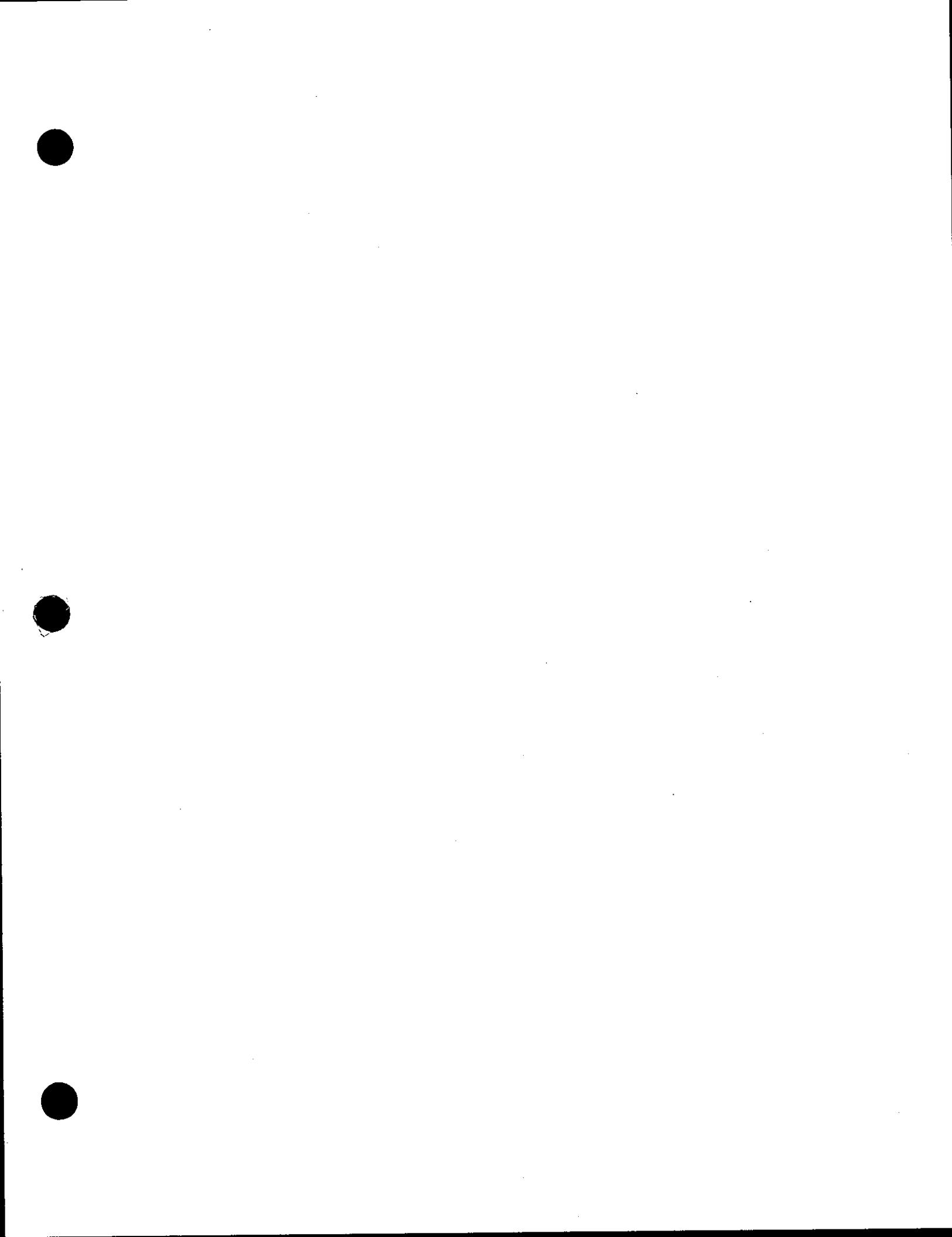


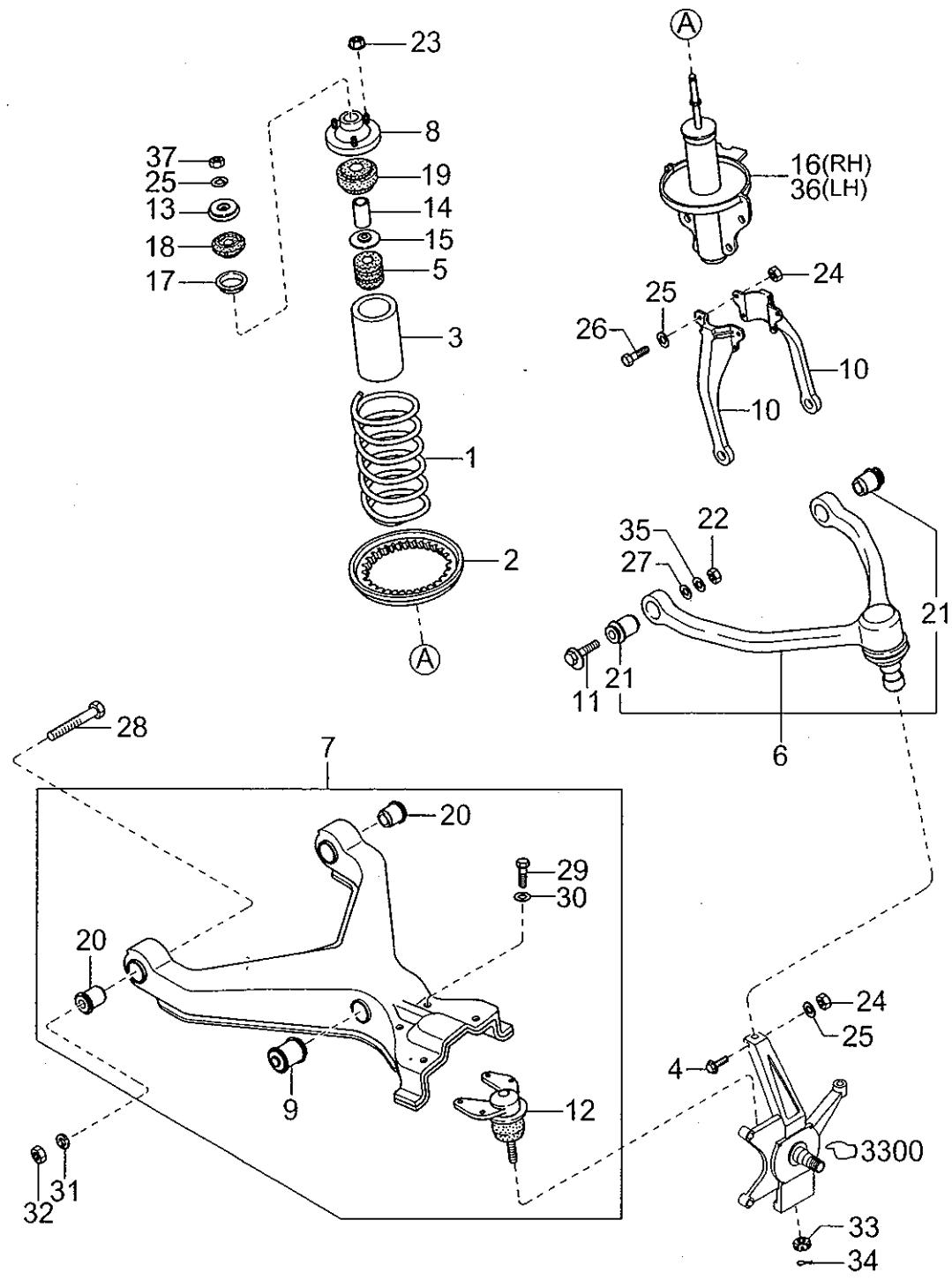




Front View







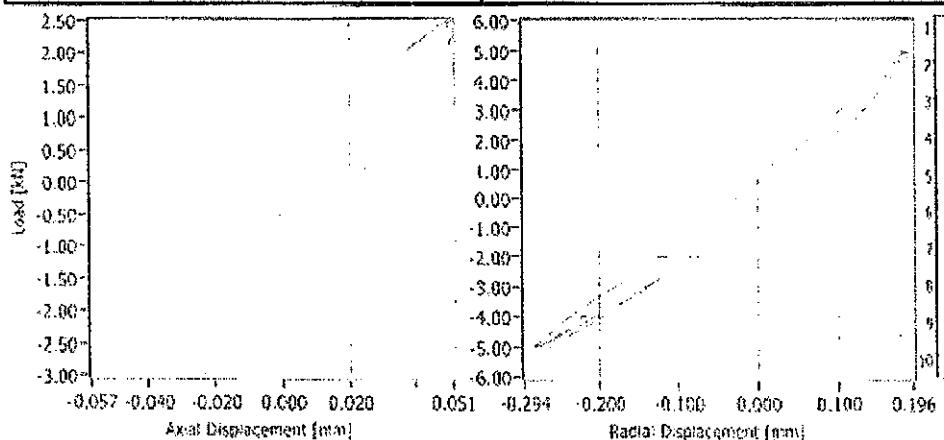
NO FROM-TO	PART NAME DESCRIPTION	I T C	PART NO	Q' ty	REMARKS
1 000516-	SPRING-COIL,FRT 5DR>WGN(4WD)		OK018 34 011E	2	
000516-	5DR>WGN(2WD)		OK011 34 011D	2	
000516-	2DR		OK011 34 011D	2	
2 000516-	SEAT-RUBBER,LWR		OK011 34 012	2	
3 000516-	BOOT-DUST		OK011 34 015A	2	
4 000516-	BOLT		M8001 34 098	2	
5 000516-	STOP-F.JOUNCE		OK011 34 111	2	
6 000516-	ARM ASSY-UP.,RH		OK011 34 200A	2	
7 000516-	ARM ASSY-LWR		OK011 34 300F	2	
8 000516-	SEAT-SPROCK		OK011 34 390C	2	
9 000516-	BUSH-FORK		OK080 34 840	2	
10 000516-	FORK		OK011 34 411	4	
11 000516-	SPINDLE-UP.ARM		OK011 34 430B	4	
12 000516-	BALL JOINT-LWR		OK011 34 510B	2	
13 000516-	RETAINER-UP.		OK011 34 701A	2	
14 000516-	BOSS		OK011 34 702	2	
15 000516-	RETAINER-LWR		OK011 34 703A	2	
16 000516-	DAMPER ASSY-FRT,RH		OK080 34 710B	1	
17 000516-	WASHER-CENTERING		OK011 34 777A	2	
18 000516-	INSULATOR-UP.		OK011 34 797	2	
19 000516-	INSULATOR-LWR		OK011 34 799A	2	
20 000516-	BUSH-ARM,LWR		OK011 34 820A	4	
21 000516-	BUSH-UP.ARM		OK011 34 830A	4	
22 000516-	NUT		K99921 1200	4	
23 000516-	NUT-FLANGE		K99940 0800B	6	
24 000516-	NUT		K99921 1000	10	
25 000516-	WASHER-SPRING		K99971 1000	10	
26 000516-	BOLT				

TEST REPORT

Tester Review Approval

File Path	측정 항목 (TEST ITEM): 축 및 원심력 헤드 트레일 (AXIAL AND RADIAL END TRAVEL)					
고객 명 (CUSTOMER)	KMC	차종 (CAR MODEL)	HB-7	부품명 (PART NAME)	RUCA ASSY	
BOM No.		LOT No.		제작일 (REQUEST DATE)		
시험 목적 (TEST PURPOSE)	<input type="checkbox"/> 개발자문 <input type="checkbox"/> 초기점검 <input type="checkbox"/> 공정점검 <input checked="" type="checkbox"/> 교체부품 <input type="checkbox"/> 연구조사 DEVELOPMENT MONITORING PROCESS POST-TEST RESEARCH			시작일 (DATE)	3/20	
	<input type="checkbox"/> SOP <input type="checkbox"/> PPAP <input type="checkbox"/> PROTO (PV) <input type="checkbox"/> PROTO (DV) <input type="checkbox"/> INITIAL SAMPLE			시작일 (DATE)	6	0CS
시험 조건 (MANUFACTURING CONDITION)	축 하중 (Axial Load): 250 kgf, 주파수 (Hz): 2.0, 축 이동 (mm): 0.22 mm 원심력 하중 (Radial Load): 500 kgf, 주파수 (Hz): 2.0, 원심력 이동 (mm): 0.23 mm					
시험 방법 (METHOD)						

시험 결과 (Test Result)							
축 이동 (Axial End Travel) [mm]				원심력 이동 (Radial End Travel) [mm]			
No.	Compressive Disp.	Tensile Disp.	Total Displ.	No.	Compressive Disp.	Tensile Disp.	Total Displ.
1	0.051	-0.044	0.095	1	0.190	-0.294	0.405
2	0.047	-0.050	0.097	2	0.193	-0.281	0.473
3	0.051	-0.055	0.106	3	0.187	-0.283	0.470
4	0.051	-0.048	0.099	4	0.196	-0.285	0.478
5	0.049	-0.051	0.100	5	0.185	-0.265	0.449
6	0.050	-0.057	0.107	6	0.187	-0.270	0.456
7				7			
8				8			
9				9			
10				10			



CTR Laboratory

TEST REPORT

Tester Review Approval



CTR Laboratory

TEST REPORT

Tester Review Approval

File Path

시험 항목

TEST ITEM:

축과 반경 이동 허용 범위 (AXIAL AND RADIAL END TRAVEL)

고객

CUSTOMER:

KNC

제품

CAR MODEL:

HB-7

부품

PART NAME:

RJCA ASS'Y

ITEM No.

LOT No.:

인증서

RECOGNITION

호환성

COMPATIBILITY

4/18

시험 목적

TEST PURPOSE:

- 개발 시험
- 증가 감시
- 공정 검사
- 고정 모드
- 향후 분석
- 시험장

인증

RECOGNITION

4/18

- SOP
- PPAP
- PROTO (PV)
- PROTO (DVI)
- INITIAL SAMPLE

3

pcs

제작 (제작) 조건

공정 대상

시험 방법

METHOD:

제작 (제작) 조건

공정 대상

방법

METHOD:

방법

방법

방법

METHOD:

방법

Schedule 1 - Normal Maintenance

MAINTENANCE INTERVALS		Number of months or miles (kilometers), whichever comes first								
		Months	7.5	15	22.5	30	37.5	45	52.5	
		Miles	7,500	15,000	22,500	30,000	37,500	45,000	52,500	
MAINTENANCE ITEM	(km)	(km)	(12 000)	(24 000)	(36 000)	(48 000)	(60 000)	(72 000)	(84 000)	(96 000)
		Drive belts (tension)				I				I
Engine oil		R	R	R	R	R	R	R	R	
Engine oil filter		R	R	R	R	R	R	R	R	
Engine timing belt (1)	Outside California	Replace every 60,000 miles (96 000 km)								
	California	Inspect at 60,000 miles (96 000 km) and 90,000 miles (144 000 km)(2) Replace every 105,000 miles (168 000 km)								
Air cleaner element					R				R	
Spark plugs					R				R	
Transfer case oil (if equipped)			I		R, I		I		R	
Manual (automatic) transmission fluid		I	I	I	R	I	I (R)	I	I	
Front differential fluid (if equipped)		I	I	I	R	I	I	I	I	
Rear differential fluid		I	I	I	R	I	I	I	I	
Cooling system					I				I	
Engine coolant					R				R	
PCV valve									I	
Ignition wires									I	
Idle speed					I (2)				I (1)	
Fuel filter					R (1)				R (1)	
Fuel line and hoses					I (2)				I	
Fuel line and hoses (California)					I (2)				I (2)	
Hose and tube for emission	Outside of California								I	
	California								I (2)	
Replace every 105,000 miles (168 000 km)										
Brake lines and connections					I				I	
Drum brakes					I				I	
Disc brakes			I		I				I	
Steering operations and linkage					I				I	
Front suspension ball joints					I				I	
Driveshaft dust boots			I		I		I		I	
Front and rear driveshaft u-joints			L		L		L		L	
Chassis/body nuts and bolts					I				I	
Exhaust system heat shield					I				I	
All locks and hinges	L	L	L	L	L	L	L	L	L	
Air conditioner refrigerant (if equipped)	Inspect refrigerant amount annually									
Air conditioner compressor (if equipped)	Inspect operation annually									

I: Inspect and, if necessary, adjust, correct, clean or replace.

L: Lubricate.

R: Replace or change.

(1) This maintenance is required in all states except California. However, we recommend that it also be performed on California vehicles.

(2) This maintenance is recommended by Kia. However, it is not necessary for emission warranty coverage or manufacturer recall liability.

01-4 SCHEDULED MAINTENANCE SERVICES

Schedule 2 - Severe Maintenance

MAINTENANCE ITEM	MAINTENANCE INTERVALS	Number of months or miles (kilometers), whichever comes first												
		Months	5	10	15	20	25	30	35	40	45	50	55	60
		Miles (x 1,000)	5	10	15	20	25	30	35	40	45	50	55	60
(km x 1,000)	(km x 1,000)	(8)	(16)	(24)	(32)	(40)	(48)	(56)	(64)	(72)	(80)	(88)	(96)	
Drive belts (tension)							I						I	
Engine oil		R	R	R	R	R	R	R	R	R	R	R	R	
Engine oil filter		R	R	R	R	R	R	R	R	R	R	R	R	
Engine timing belt (1)	Outside California	Replace every 60,000 miles (96 000 km)												
	California	Inspect at 60,000 miles (96 000 km) and 90,000 miles (144 000 km)(2) Replace every 105,000 miles (168 000 km)												
Air cleaner element				I (2&3)			R			I (2&3)			R	
Spark plugs							R						R	
Transfer case oil (if equipped)	I	I	R	I	I	R	I	I	R	I	I	I	R	
Manual (automatic) transmission fluid	I (1)	I (1)	R (1)	I (1)	I (R)	R (1)	I (1)	I (1)	R (1)	I (R)	I (1)	I (1)	R (1)	
Front differential fluid (if equipped)	I	I	R	I	I	R	I	I	R	I	I	I	R	
Rear differential fluid	I	I	R	I	I	R	I	I	R	I	I	I	R	
Cooling system						I							I	
Engine coolant						R							R	
PCV valve													I	
Ignition wires													I	
Idle speed						I (2)							I (1)	
Fuel filter							R (1)						R (1)	
Fuel line and hoses						I (2)							I	
Fuel line and hoses (California)						I (2)							I (2)	
Hose and tube for emission	Outside of California												I	
	California												I (2)	
Replace every 105,000 miles (168 000 km)														
Brake lines and connections							I						I	
Drum brakes							I						I	
Disc brakes			I			I			I				I	
Steering operations and linkage						I							I	
Front suspension ball joints						I							I	
Driveshaft dust boots						I							I	
Chassis/body nuts and bolts			I			I			I				I	
Exhaust system heat shield						I							I	
All locks and hinges	L	L	L	L	L	L	L	L	L	L	L	L	L	
Air conditioner refrigerant (if equipped)	Inspect refrigerant amount annually													
Air conditioner compressor (if equipped)	Inspect operation annually													
Front and rear driveshaft u-joints		L		L		L		L		L		L	L	

I: Inspect and, if necessary, adjust, correct, clean or replace.

L: Lubricate.

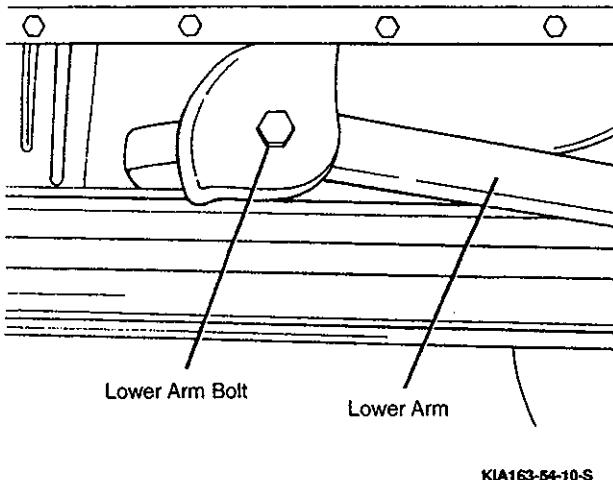
R: Replace or change.

(1) This maintenance is required in all states except California. However, we recommend that it also be performed on California vehicles.

(2) This maintenance is recommended by Kia. However, it is not necessary for emission warranty coverage or manufacturer recall liability.

(3) Inspect, and if necessary, replace.

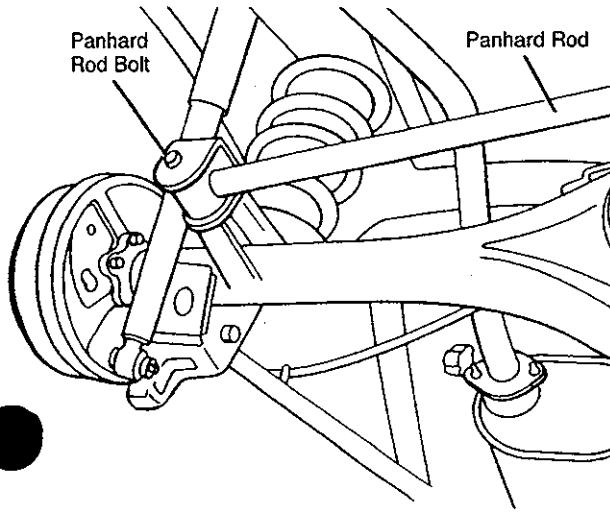
2. Loosen the installation bolts.
3. Inspect for damage, deformation or cracking of the lower arm.
4. Inspect for wearing or deterioration of the lower arm bushing.
5. Remove and replace if damaged, deformed or cracked; replace bushing if worn or deteriorated. Refer to "On-Vehicle Service" in this section.



KIA163-54-10-S

Panhard Rod Assembly

- Raise the rear of the vehicle and support it with safety stands.
- 2. Raise up the rear housing to relieve tension on the panhard rod.
- 3. Loosen the panhard rod bolts.
- 4. Inspect for damage, deformation or cracking of the panhard rod.
- 5. Inspect for wearing or deterioration of the panhard rod rubber bushing.
- 6. Remove and replace if rod is damaged, deformed or cracked; replace bushing if worn or deteriorated. Refer to "On-Vehicle Service" in this section.



KIA163-54-11-S

ON-VEHICLE SERVICE

WARNING

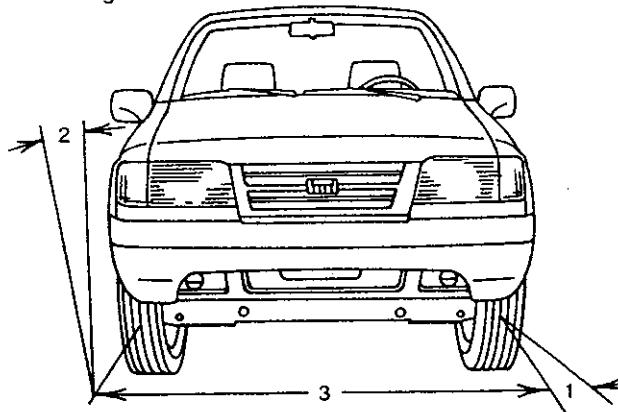
PROVIDE SUFFICIENT SUPPORT FOR THE VEHICLE TO REDUCE THE POSSIBILITY OF THE VEHICLE FALLING, CAUSING PERSONAL INJURY OR DEATH.

FRONT SUSPENSION

Front Wheel Alignment

Wheel alignment refers to the angular relationship between the wheels, control arms, suspension and the ground. It deals with tire camber, caster, toe-in and wheel balancing. Proper wheel alignment and wheel balance insures a safe, quiet ride with minimal tire wear. This section assumes that all components are in good working condition. Performing this exercise may also detect any problem areas in the front suspension. It is advisable to replace defective components before attempting a wheel alignment.

Wheel Alignment



KIA163-54-12-S

Inspection

1. Inspect tires for proper balance and inflation. Balance tires and set to the recommended pressure if necessary.
2. Inspect front wheel bearing play and reduce the bearing play; replace any defective bearings.
3. Inspect for any excessive looseness of the ball joints and steering center link.
4. Place the vehicle on level ground and confirm that there are no passengers or luggage on board.
5. Push down on the front of the vehicle to determine the correct operation of the shock absorbers.

Camber

Camber is the tilting of the front wheels from the vertical when viewed from the front of the vehicle. When the wheels tilt outward at the top, the camber is "positive" (+). When the wheels tilt inward at the top, the camber is "negative" (-). The amount of tilt is measured in degrees from the vertical. Camber setting will influence directional control and tire wear.

SPECIFICATIONS

FASTENER TIGHTENING SPECIFICATIONS

FRONT SUSPENSION

Drop Link Nut	145 lb-ft (197 N·m)
Front Fork Bolts	36 lb-ft (48 N·m)
Lower Control Arm Ball Joint-to-Steering Knuckle Bolt	87 lb-ft (118 N·m)
Lower Control Arm Bushing Bolts	206 lb-ft (280 N·m)
Lug Nuts	74 lb-ft (100 N·m)
Piston Rod Nut	31 lb-ft (42 N·m)
Pivot Link Bolts	31 lb-ft (42 N·m)
Spindle Nuts	62 lb-ft (84 N·m)
Spring Seat Nut	18 lb-ft (25 N·m)
Stabilizer Bar Plate Bolts	18 lb-ft (25 N·m)
Stabilizer-to-Drop Link Nuts	36 lb-ft (48 N·m)
Tie-Rod Lock Nuts	76 lb-ft (103 N·m)
Upper Control Arm Ball Joint Link-to-Steering Knuckle Bolt	36 lb-ft (48 N·m)

REAR SUSPENSION

Lower Arm Assembly Bolts	62 lb-ft (84 N·m)
Lug Nuts	74 lb-ft (100 N·m)
Panhard Arm Bolts	62 lb-ft (84 N·m)
Shock Absorber Lower Bolt	62 lb-ft (84 N·m)
Shock Absorber Upper Nut	44 lb-ft (60 N·m)
Upper Arm Assembly Bolts	62 lb-ft (84 N·m)

GENERAL SPECIFICATIONS

Suspension Type	Double Wishbone Coil Spring
Front	
Wheel Alignment	
Toe-in	
No Passenger Load	0.098 ± 0.098 in (2.5 ± 2.5 mm)
2 Passenger Load	0 ± 0.098 in (0 ± 2.5 mm)
Camber	
No Passenger Load	0.44° ± 0.76°
2 Passenger Load	0° ± 0.76°
Caster	
No Passenger Load	3.58° ± 0.76°
2 Passenger Load	3.85° ± 0.76°
Front Shock Absorber Type	Double-acting, oil filled
Rear	
Suspension Type	4 Link Coil Spring
Wheel Alignment	
Toe-in (in (mm))	0
Camber	0
Rear Shock Absorber Type	Double-acting, oil filled

Quality Assurance Chart
 Vehicle Model : NB-7
 Part Name: Upper Control Arm Ass'y

Drawing Number : OK011 34 210
 Vendor Name:
 Part Name:

Vendor Name: Central Inc.
 (Responsible Team: Central
 Technology Research Center Laboratory)

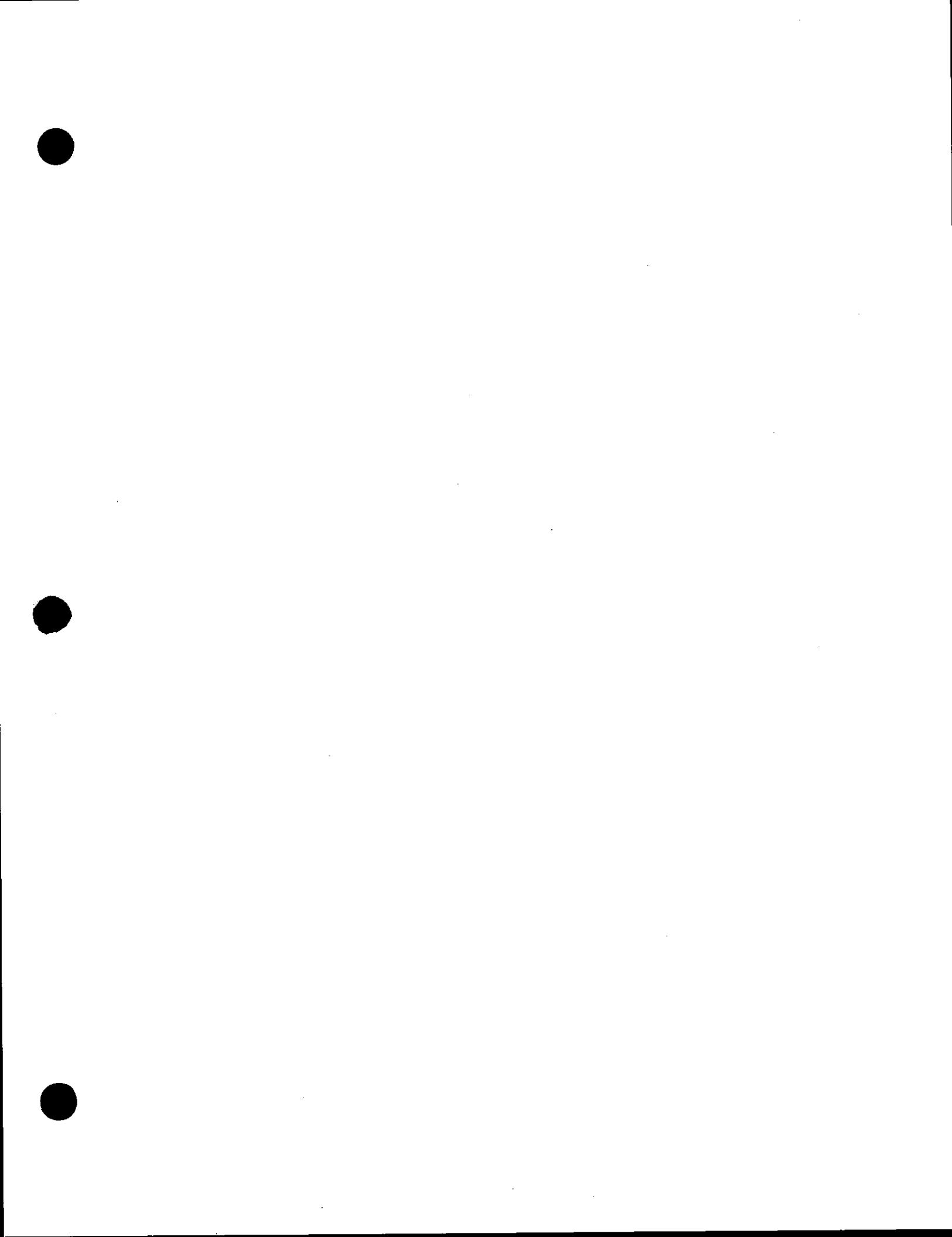
Test Classification	No	Test Item	Test Methods and Condition	Test Standards	Quality	Test Result	Judge ment	Dates
Performance Test	1	Rotating Maneuver Torque	Measure after 24 hours without operation	Below 180 kgf.cm	n=3	No.1 75 kgf.cm No.2 72 kgf.cm No.3 62 kgf.cm	OK	3/20/2001
	2	Rotating Function Torque	In 20° C, ± 30° rotation 1 time, ± 15° rotation 5 times, then measure stable rotation torque	10~30 kgf.cm	n=3	No.1 18.53 kgf.cm No.2 14.76 kgf.cm No.3 22.03kgf.cm	OK	3/20/2001
	3	Oscillating Torque	Measure ± 5°, 12 Hz Torque	10% above rotation function torque	n=3	No.1 43.87 kgf.cm 237% No.2 38.33 kgf.cm 260% No.3 37.79 kgf.cm 164%	OK	3/20/2001
	4	End Travel Test	Measure deformation quantity after 250 kgf load on axis direction for Ball Stud	Below 0.22 mm	n=3	No.1 0.057mm No.2 0.059 mm No.3 0.059 mm	OK	3/20/2001
	5	Tensile Load	Measure deformation quantity after 500 kgf load on radial direction for Ball Stud	Below 0.23 mm	n=3	No.1 0.226 mm No.2 0.221 mm No.3 0.220 mm	OK	3/20/2001
	6	Pressure Load	Tensile load on axis direction until Ball Stud separation from socket occurs.	Above 3,000 kgf	n=3	No.1 3501.1 kgf No.2 3421.9 kgf No.3 3496.5 kgf	OK	3/22/2001
	7	Stud Static Bending	Pressure load on axis direction until Ball Stud separation from socket occurs.	Above 1,500 kgf	n=3	No.1 2398.4 kgf No.2 2507.5 kgf No.3 2747.9 kgf	OK	3/22/2001
	8	Stud Fatigue Bending	Static bending load of 2300 kgf on Ball Stud Fatigue bending load on Stud 100~1200kgf x 700 cpm x 1,000,000 times	There should be no crack or damage on Ball Stud	n=3	No.01~03 No Ball Stud damage or crack	OK	3/22/2001 ~ 3/27/2001

Test Classification	No	Test Item	Test Methods and Condition	Test Standards	Quality	Test Result	Judge ment	Dates
Strength Testing	9	Stud Fatigue Distortion	Fatigue distortion load on Stud ± 1200kgf × 700 cpm × 1,000,000 times	There should be no fatigue destruction	n=2	No. 01~02 No fatigue destruction	OK	3/22/2001 ~ 3/27/2001
	10	Stud Free Fall Impact	Drop 50 kgf weight, load 12 kgf.m impact load on Stud	The deformation should be less than 2.1 mm	n=3	No.1 1.79 mm No.2 1.90 mm No.3 1.74 mm	OK	4/2/2001
	11	Radial Load	In 37°C, load 3000 kgf on radial direction of Stud in Assy	There should be no ball joint damage	n=2	No. 01~02 No Ball Joint Damage	OK	3/22/2001
	12	Low Temperature Impact Load	In -35°C, load 10 times 2500 kgf on radial direction of Stud in Assy	There should be no ball joint damage	n=2	No. 01~02 No Ball Joint Damage	OK	3/22/2001
Ass'y Load	13	Ass'y Load	Load 10 times on Stud for Assy Vehicle front & back: 866 Vehicle Inside: 1528 Vehicle vertical: 590	No deformation on Arm	n=3	No. 01~03 No Arm deformation	OK	3/30/2001
	14	Bush Separation	Pressure load 30 mm/min on axis direction of Bush until Bush separation	Above 1,000 kgf	n=3	No.1 3155.3 kgf No.2 5180.8 kgf No.3 4701.7 kgf	OK	3/27/2001
	15	Wear and Tear Durability	See Attachment	After Durability Test, Axis End Travel: 0.1mm/30kgf Radial End Travel: 0.15 mm / 200 kgf Rotation Torque : Above 1kgf.cm No Dust Cover Damage No Stud crack or deformation No damage on internal parts No problem on Grease status	n=3	No. 01 No. 02 No. 03 Axis 0.017 0.019 0.018 mm Radial 0.117 0.119 0.114 mm Torque 4.4 2.4 3.7 kgf.cm Rotation Torque left No Dust Cover crack or deformation No Stud crack or deformation No problem on Grease status	OK	3/20/2001 ~ 4/11/2001

Test Classification	No	Test Item	Test Methods and Condition	Test Standards	Quality	Test Result	Judge ment	Dates
Durability Test	16	Reflection Durability	Oscillation: $\pm 15 \times 1.2 \text{ Hz}$ x 500,000 Rotation: $\pm 30 \times 1.2 \text{ Hz}$ Atmosphere: NSU JIS 8 (1 min/10mins), normal temperature Radial Load (Static): $\pm 300 \text{ kgf}$ Radial Load (Move) $\pm 140 \text{ kgf}$	After Durability Test, Axis End Travel: 0.1mm/30kgf Radial End Travel:0.15 mm / 200 kgf Rotation Torque : Above 1kgf.cm No Dust Cover Damage No Stud crack or deformation No damage on internal parts No problem on Grease status	n=3	After Test, No. 01 No. 02 No. 03 Axis 0.005 0.007 0.006 mm Radial 0.074 0.091 0.078 mm Torque 26.4 30.4 31.7 kgf.cm No. 01 ~No.03 Rotation Torque left No Dust Cover crack or deformation No Stud crack or deformation No problem on Grease status	OK	3/30/2001 ~ 4/16/2001
Seal Test	17	Climatic Test	Ozone exposure to ball joint stud with maximum movement angle based on ASTM-D117-68	There should be no crack or any other change on Dust Cover after 72 hours.	n=3	After 72 hours, No.01 ~ No.03 No crack or unusual change	OK	3/23/2001 ~ 3/26/2001
	18	Low Temperature Seal Test	In -35°C, perform several rotations and oscillations.	Seal should remain intact.	n=3	No.01 ~No.03 Seal should remain intact. No crack or damage	OK	4/16/2001

15 Wear and Tear Durability Test Methods and Condition

No	Ball Stud			Temp	Repeat Speed	Number of Repeated Load Cycle	Atmosphere
	Oscillating Angle	Rotation Angle	Radial Load				
1	± 7	-	± 450		2~3	300,000	NISU JIS 8
2	± 15	± 30	± 750		1~1.5	150,000	
3	± 15	± 30	± 1,100	Normal	1~1.5	50,000	
4	± 7	-	± 450	Temperature	2~3	3,000	
5	± 3	-	± 250		6~12	2,200,000	Dry
6	± 15	± 30	± 750		1~1.5	3,000	NISU JIS 8



품질보증표
부품명 : Upper Control Arm Ass'y

도면번호 : OK011 34 210
업체번호 :

제작업체 : 신설트루
(설계부서 : 기술연구소 시험실)

시험분류	No.	시험항목	시험방법 및 조건	평가기준	수량	시험결과	판정	일정	
성능시험	1	회전기동 Torque 측정.	작동상태 없이 송로에서 24h 양자 후.	180 kgf.cm 이하.	n=3	No.01 75 kgf.cm No.02 72 kgf.cm No.03 62 kgf.cm	OK	2001.03.20	
	2	회전작동 Torque 20°C에서 ±30° 회전 1회, ±15°회전 5회 후, 안정된 회전 Torque 측정.	10 ~ 30 kgf.cm		n=3	No.01 18.53 kgf.cm No.02 14.76 kgf.cm No.03 23.03 kgf.cm	OK	2001.03.20	
	3	扭转 Torque ±5°, 12Hz Torque 측정.	회전 작동 Torque 외 10% 이상		n=3	No.01 43.87 kgf.cm No.02 38.33 kgf.cm No.03 36.79 kgf.cm	237% 260% 164%	OK	2001.03.20
	4	구멍 Ball Stud 축팅으로 250 kgf의 하중을 기한 후, 번위랑을 측정.	0.22 mm 이하.		n=3	No.01 0.057 mm No.02 0.059 mm No.03 0.059 mm	OK	2001.03.20	
강도시험	5	인발	Ball Stud 축팅으로 500 kgf의 하중을 기한 후, 번위랑을 측정.	0.23 mm 이하.	n=3	No.01 0.226 mm No.02 0.221 mm No.03 0.220 mm	OK	2001.03.20	
	6	입발	Ball Stud 축팅으로 인장하중을 기하여 Socket으로부터 Ball Stud를 이탈.	3,000 kgf 이상	n=3	No.01 3501.1 kgf No.02 3421.9 kgf No.03 3496.5 kgf	OK	2001.03.22	
	7	Stud 광학 Stucco	Stud에 광학 굽힘 하중 230kgf을 부하.	1,500 kgf 이상	n=3	No.01 2398.4 kgf No.02 2507.5 kgf No.03 2747.9 kgf	OK	2001.03.22	
	8	Stud 파로급힘	Stud에 파로 급힘 하중을 부하.	Ball Stud 파손 및 균열 없을 것. 파로 파괴 없을 것.	n=3	No.01 ~ 03 파로 파괴 없음.	OK	2001.03.22	
9	9	Stud 파로비틀힘	Stud에 파로 비틀림 하중을 부하.	파로 파괴 없을 것.	n=2	No.01 ~ 02 파로 파괴 없음.	OK	2001.03.27 ~2001.03.31	
	10	Stud 낙하충격	Stud에 50kgf의 추ップ 차유부착시켜 12kgf.cm 의 충격하중을 부하.	변형량 2.1mm 이하.	n=3	No.01 1.79 mm No.02 1.90 mm No.03 1.74 mm	OK	2001.04.02	
	11	용방향 대하중	37°C에서 Ass'y에 Stud의 월방향으로 300kgf 의 하중을 부하.	Ball Joint에 파손 없을 것.	n=2	No.01 ~ 02 Ball Joint에 파손 없음.	OK	2001.03.22	
	12	저온충격	-35°C에서 Ass'y에 Stud의 월방향으로 2500kgf의 충격하중을 10회 부하.	Ball Joint에 파손 없을 것.	n=2	No.01 ~ 02 Ball Joint에 파손 없음.	OK	2001.03.22	
Ass'y 대하중	13	Ass'y 대하중	Ass'y 상체에서 Stud에 아래의 하중을 10회 부하. 차량 전후 방향 : 886 kgf 차량 내수 방향 : 1528 kgf 차량 수직 방향 : 590 kgf	Arm 끝에 변형 없을 것.	n=3	No.01 ~ 03 Arm 끝에 변형 없음.	OK	2001.03.30	
	14	Bush 빠짐	Bush 축 방향으로 30mm/분으로 압밀하중을 부하시하여 Bush 이탈.	1,000 kgf 이상	n=3	No.01 3155.3 kgf No.02 5180.8 kgf No.03 4701.7 kgf	OK	2001.03.27	
		시험분류	시험방법 및 조건	평가기준	수량	시험결과	판정	일정	

내구 시험	15 마모 내구	내구 후 충유액 : 0.1mm / 30kgf 충유량 : 0.15mm / 200kgf 회전 Torque : 1kgf.cm 이상 Dust cover 파괴 없을 것. Stud 굽힘, 변형없을 것. 내부부품 손상 없을 것. 잔존 Grease 이상 없을 것.	n=3 시험후, No.01 No.02 No.03 충방창 충방창 0.117 0.119 0.114 mm Torque 4.4 2.4 3.7 kgf.cm 회전 Torque가 전존. Dust cover 굽힘, 변형 없음. Stud 굽힘, 변형없음. Seat 파단. 잔존 Grease 이상 없음.
	16 풀절 내구	내구 후 충유액 : 0.1mm / 30kgf 충유량 : 0.15mm / 200kgf 회전 Torque : 1kgf.cm 이상 Dust cover 파괴 없을 것. Stud 굽힘, 변형없을 것. 내부부품 손상 없을 것. 잔존 Grease 이상 없을 것.	n=3 시험후, No.01 No.02 No.03 충방창 충방창 0.005 0.007 0.006 mm Torque 26.4 30.4 31.7 kgf.cm 회전 Torque가 전존. Dust cover 굽힘, 변형 없음. Stud 굽힘, 변형없음. 내부부품 손상 없음. 잔존 Grease 이상 없음.
Seal 시험	17 내후성 18 재운 Seal성	Ball joint의 Stud를 최대 요동각상태로 하여, ASTM-D1117-68에 준한 Ozone에 노출. -35°C에서 수화 전자등(요동/회전)시킬 것.	n=3 72시간 후, No.01 ~ 03 충방창 및 이상 변화 없음. OK 2001.03.23 ~2001.03.26
			n=3 72시간 후, No.01 ~ 03 충방창 및 이상 변화 없음. OK 2001.04.16

Test Report

Tester	Review	Approval

File Path						
시험 항목 (TEST ITEM)	회전 및 요동 TORQUE 성능 시험 (ROTATING AND OSCILLATING TORQUE)					
업체 (CUSTOMER)	KMC	제작 (CAR MODEL)	NB-7	품명 (PART NAME)	RUCA ASSY	
BOM No.		Lot No.		이급자 (REQUESTER)	총괄팀	
시험 목적 (TEST PURPOSE)	<input checked="" type="checkbox"/> 개발시점 <input type="checkbox"/> 정기감사 <input type="checkbox"/> 공정감사 <input type="checkbox"/> 고문분석 <input type="checkbox"/> 연구분석 <small>(DEVELOPMENT MONITORING PROCESS POST-TEST RESEARCH)</small>					시작일 (DATE)
	<input type="checkbox"/> SOP <input type="checkbox"/> PPAP <input type="checkbox"/> PROTO (PV) <input type="checkbox"/> PROTO (DV) <input type="checkbox"/> INITIAL SAMPLE					시료수 (QUANTITY)
조립 (제작) 조건 (MANUFACTURING CONDITION)						
시험 방법 (METHOD)	2 cycle	720 deg	3 RPM	평가 기준 (CRITERIA)	10~30 kgf.cm	
시험 결과 (TEST RESULTS)						
회전 TORQUE (ROTATING TORQUE) [kgf.cm]				요동 TORQUE (OSCILLATING TORQUE) [N-m]		
No. 1	18.53	No. 6	27.23	No. 1		No. 6
2	14.76	7		2		7
3	23.03	8		3		8
4	22.02	9		4		9
5	27.57	10		5		10
<p>Sensors_Torque_0 [kgf-cm]</p> <p>시간 [Sec]</p>				<p>Channel 0 [V]</p> <p>시간 [Sec]</p>		

CTR CTR Laboratory

Test Report

Tester	Review	Approval

File Path						
시험 항목 TEST ITEM	회전 및 요동 TORQUE 성능 시험 (ROTATING AND OSCILLATING TORQUE)					
인체 CUSTOMER	KMC	차종 (CAR MODEL)	NB-7	품명 (PART NAME)	RUCA ASSY	
BOM No.		Lot No.		요청자 (REQUESTER)	충정원	
시험 목적 TEST PURPOSE	<input checked="" type="checkbox"/> 개발시험 <input type="checkbox"/> 정기검사 <input type="checkbox"/> 공정점검 <input type="checkbox"/> 고장분석 <input type="checkbox"/> 인구분석 <small>(DEVELOPMENT MONITORING PROCESS POST-TEST RESEARCH)</small>					
	<input type="checkbox"/> SOP <input type="checkbox"/> PPAP <input type="checkbox"/> PROTO(PV) <input type="checkbox"/> PROTO(DV) <input type="checkbox"/> INITIAL SAMPLE			시작일 (DATE)	4/18	
조립 (제작) 조건 (MANUFACTURING CONDITION)					사료수 (QUANTITY)	3 pcs
시험 방법 (METHOD)	2 cycle	±5 deg	12Hz	평균 기준 (REFERENCE)	회전T.Q의 ±10%이상	
시험 결과 (TEST RESULTS)						
요동 TORQUE (OSCILLATING TORQUE) [kgf.cm]			요동 TORQUE (OSCILLATING TORQUE) [N·m]			
No. 1	43.87	No. 6	No. 1		No. 6	
2	38.33	7	2		7	
3	37.79	8	3		8	
4		9	4		9	
5		10	5		10	

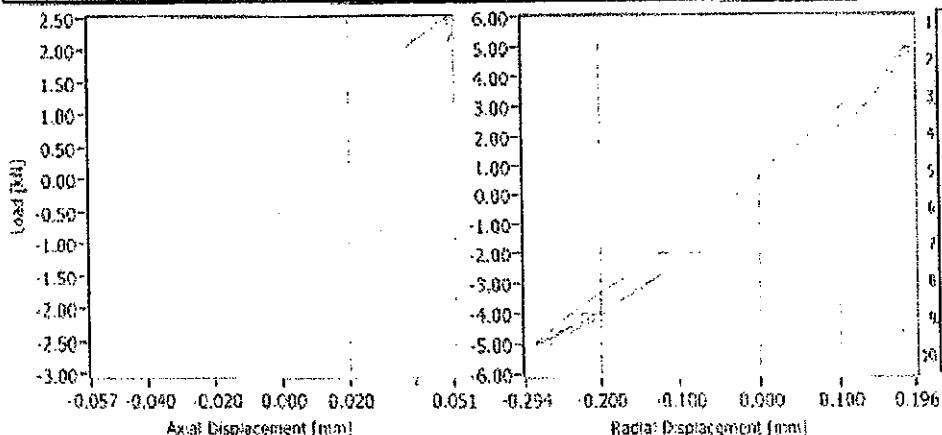


CTR Laboratory

TEST REPORT

Tester Review Approval

File Path TEST ITEM	축 및 흐름 유격 쟁동 시험 (AXIAL AND RADIAL END TRAVEL)						
CUSTOMER KMC	기종 IGAR MODEL HB-7	부품 PART NAME RUCA ASSY					
BOM No.	LOT NO.	설정 SETUP	설정 SETUP	설정 SETUP	설정 SETUP	설정 SETUP	
<input type="checkbox"/> 개발시험 <input type="checkbox"/> 성가감사 <input type="checkbox"/> 공정점검 <input checked="" type="checkbox"/> 교통분석 <input type="checkbox"/> 향후분석		날짜 (DATE)	3/20				
<input type="checkbox"/> SOP <input type="checkbox"/> PPAP <input type="checkbox"/> PROTO (PV) <input type="checkbox"/> PROTO (DV) <input type="checkbox"/> INITIAL SAMPLE		수량 (QTY)	6 pcs				
제작 조건 (MANUFACTURING CONDITION)							
시험 방법 METHOD	축 하중 AXIAL LOAD 250 kgf	Hz	측정 기준 CRITERIA	축 유격 AXIAL END TRAVEL 0.22 mm	측정 기준 CRITERIA	축 유격 RADIAL END TRAVEL 0.23 mm	
시험 결과 (Test Result)							
축 유격 (AXIAL END TRAVEL) [mm]				흐름 유격 (RADIAL END TRAVEL) [mm]			
No	Compressive Disp.	Tensile Disp.	Total Displ.	No	Compressive Disp.	Tensile Disp.	Total Displ.
1	0.051	-0.044	0.095	1	0.190	-0.294	0.485
2	0.047	-0.050	0.097	2	0.193	-0.281	0.473
3	0.051	-0.055	0.106	3	0.187	-0.283	0.470
4	0.051	-0.048	0.099	4	0.196	-0.283	0.476
5	0.049	-0.051	0.100	5	0.185	-0.265	0.449
6	0.050	-0.057	0.107	6	0.187	-0.270	0.456
7				7			
8				8			
9				9			
10				10			



CTR Laboratory

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Test Report

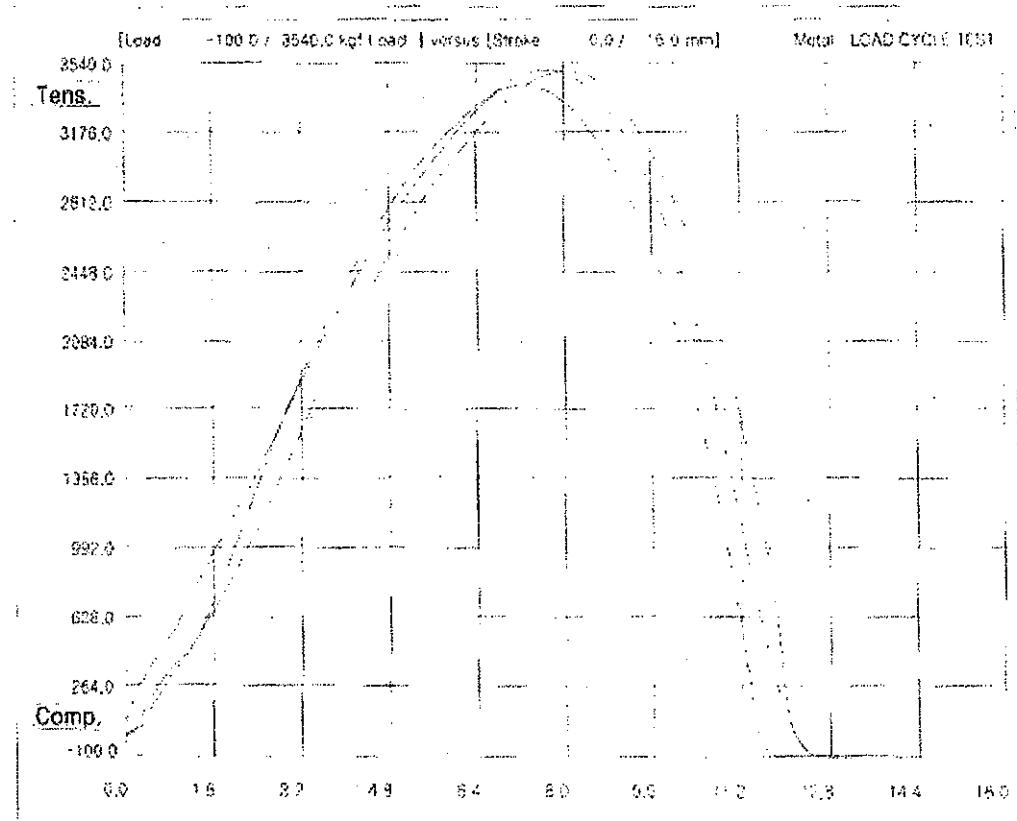
File Path:

차종(Car Model): NA-V
 부품명(Part Name): UPR ARM ASS Y
 시험회원(Test User): 현대자동차 시험
 시험속도(O'm): 3CA
 증기기준(Outline): MIN 3,000 kgf

제작처(Customer): KMC
 요청자(Requester): 김현우
 관리부서(Department): 차량
 목적(Purpose): 차량시험
 방법(Test Method):

No. & Lot.	Data	방법(Method)		회복(Compr.)		기록(Rec.)	
		수평보정 Stress (kgf)	회복률 Rate (%)	회복률 Rate (%)	기록률 Rate (%)	기록률 Rate (%)	기록률 Rate (%)
1	0	20.0	-95.1	12.7	3501.1	7.7	
2	0	20.0	-86.7	11.8	3421.9	7.3	
3	0	20.0	-83.9	12.4	3406.9	8.0	
Average		20.0	-88.6	12.3	3413.2	7.7	
Unit		kgf/mm	kgf	mm	kgf	mm	

- MEMO -



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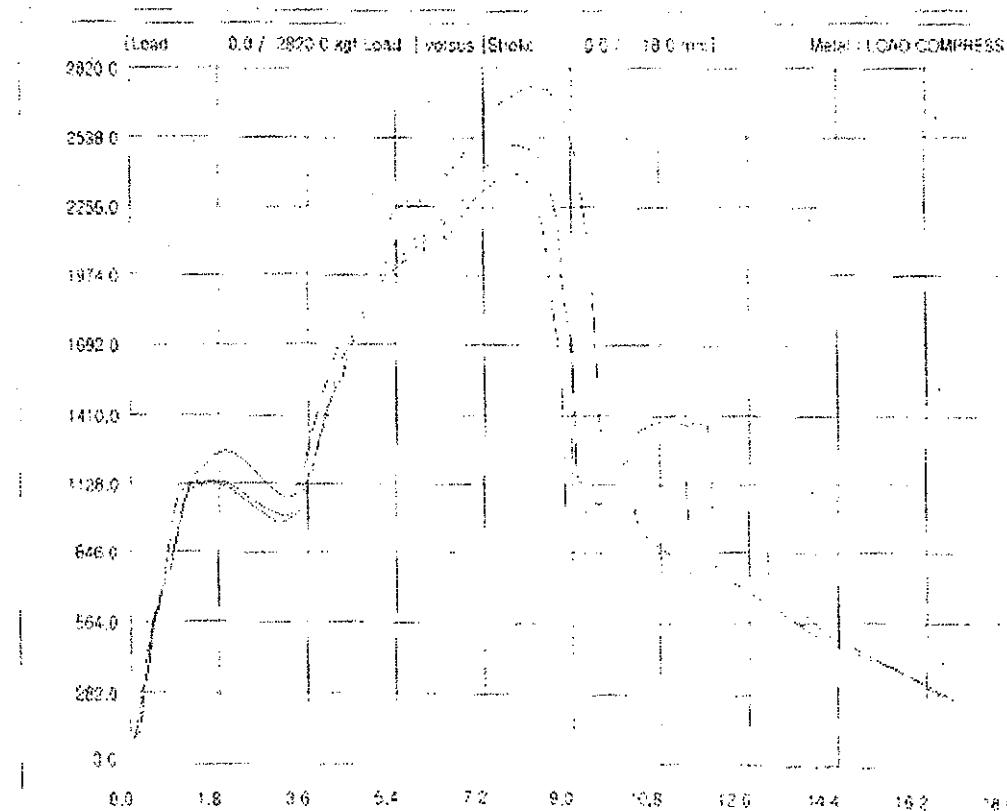
Tester Review Approval

Test Report

File Path:		Customer:	
차종(Car Model)	NG-7	고객명(Customer)	KMC
부품명(Part Name)	UPB ARM ASSY	희망자(Requester)	제작부
시험항목(Test Item)	방법 허용 시험	호흡부서(Department)	제작부
시료 수(Count)	3EA	목적(Purpose)	제작부
평가기준(Criteria)	MIN 1,500 kgf	방법(Test Method)	

NO. & Lot.	Data	방법(Method)	373±1 Pass, P.I.		
			48.8%	48.5%	95.2%
1	0	Pass	20.0	2768.4	7.7
2	0	Pass	20.0	2597.5	7.9
3	0	Pass	20.0	2747.9	8.3
Average			20.0	2661.3	8.0
Unit			mm/min	kgf	N/mm ²

- MEMO -



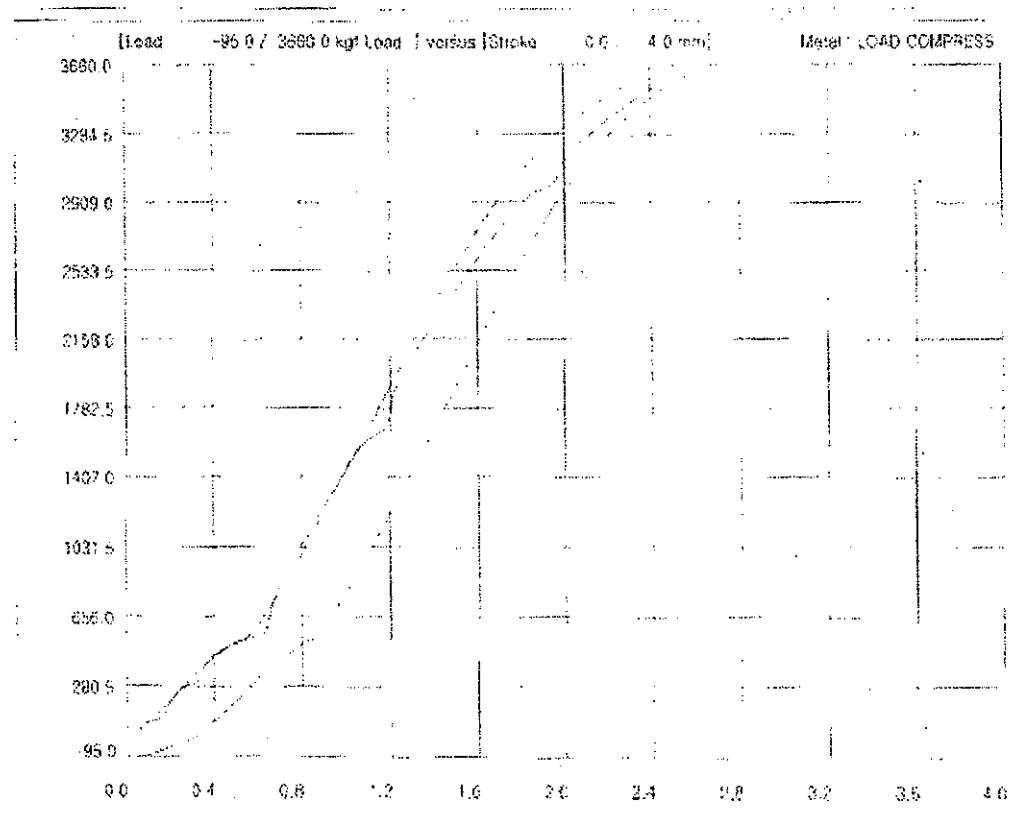
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Test Report

File Path:		Customer:	
차종(Car Model)	NB-7	담당자(Customer)	KMC
부품명(Part Name)	UPR ARM ASSY	요청자(Requester)	박현숙
시험항목(Test Item)	B/STUD 경적금화 시험	연락부서(Dept)	개발
시험수(Sample)	3EA	목적(Purpose)	제작 검증
평가 기준(Criteria)	2,300 kgf에서 평온 및 금화 없음	방법(Test Method)	
Data	방법(Method)	최대값 (Peak P)	
NO. & Lot.	(Series)	(kgf)	(mm)
1	0	20.0	3244.0
2	0	20.0	3200.4
3	0	20.0	3564.5
Average		20.0	3376.3
Unit	mm/min	kgf	mm

- MEMO -



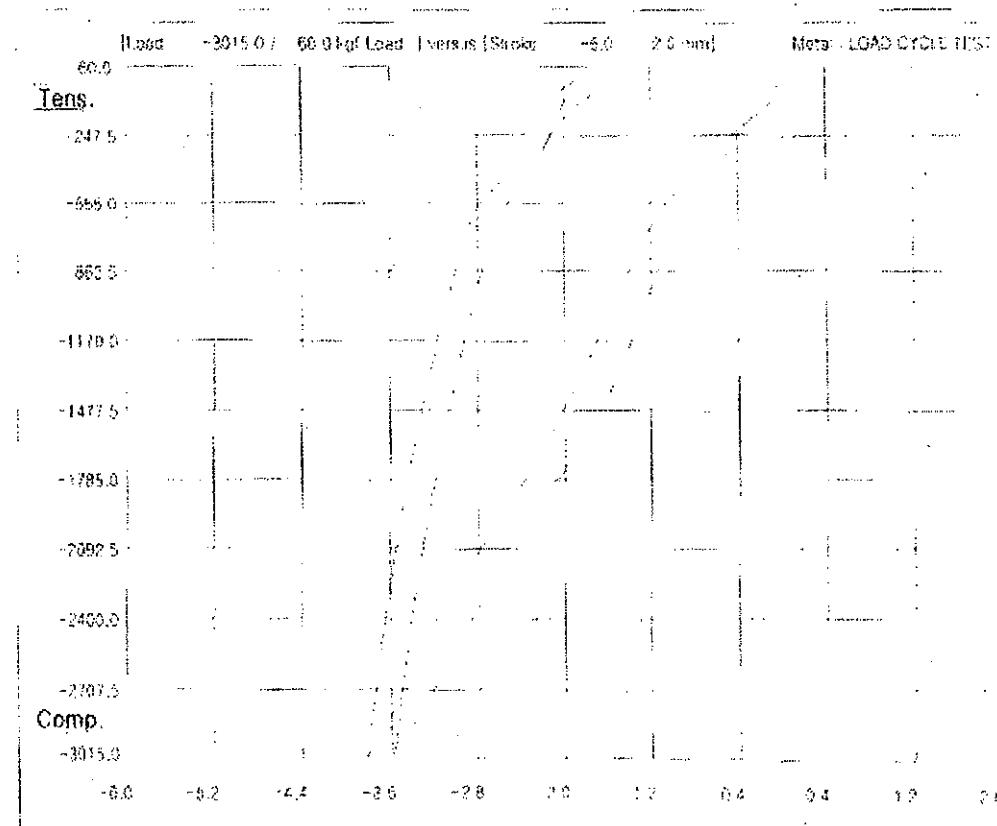
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Test Report

File Path:	NO - 7	Customer:	KMC				
Car Model:	UPR APN ASS Y	Requester:	차현웅				
Test Item:	필기장 태슬론 시험	Department:	기술				
Test ID:	ZEA	Purpose:	제작 품질				
Total Weight (kg):	3,000 kg(인증용 무게인 97,200lb, 평균 평가방법)	Test Method:					
No. & Lot	Data	Tensile (Mill sec)		Compressive (Sec)		Impact Test I	
		Load (kg)	Time (sec)	Load (kg)	Time (sec)	Impact (kgf)	Impact (kgf)
1	0	10.0	-3001.6	-3.6	0.0	0.0	
2	0	10.0	-3006.9	-3.8	0.0	0.0	
Average		10.0	-3005.2	-3.7	0.0	0.0	
Unit		kg/min	kg	mm	kgf	kgf	

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Test Report

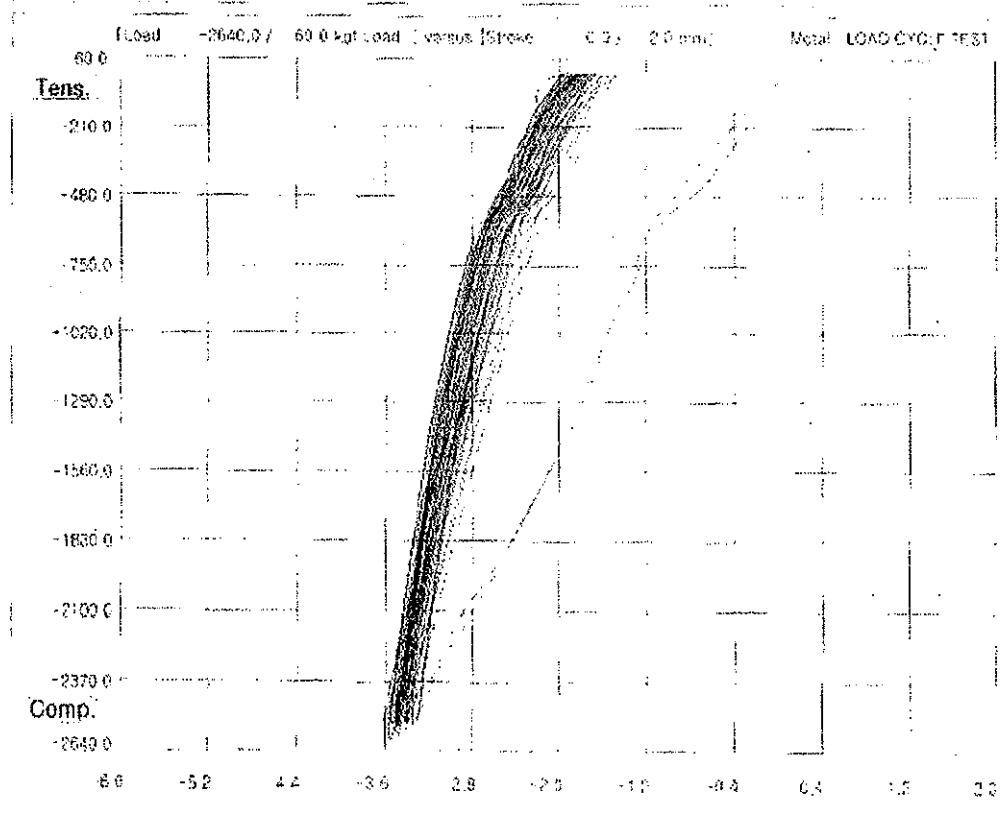
File Path:

차종(Car Model): XD-7
부품명(Part Name): UPR ARM ASS Y
시험항목(Test item): 차체 충격 테스트
시험주체(Q.L): 2EA
평가기준(Grade): 2500 kgf의 충격하중 10회 부과시 최소 성능 체크(Grade)

설정화면(Screens): EVO
실험기(Rig tested): 8000
기원부서(Department): 800
목적(Purpose): N/A

NO. 88 Lot	Data	방법(Method)		설정(Comp.)		결과(Tens.)	
		방법 4단계	속도(mm/min)	설정	설정	설정	설정
1	0	10.0	-2634.2	-3.6	5.6	-1.9	
2	0	10.0	-2633.1	-3.5	2.8	-1.7	
Average		10.0	-2629.2	-3.6	4.2	-1.8	
Unit		mm/min	kgf	mm	kgf	mm	

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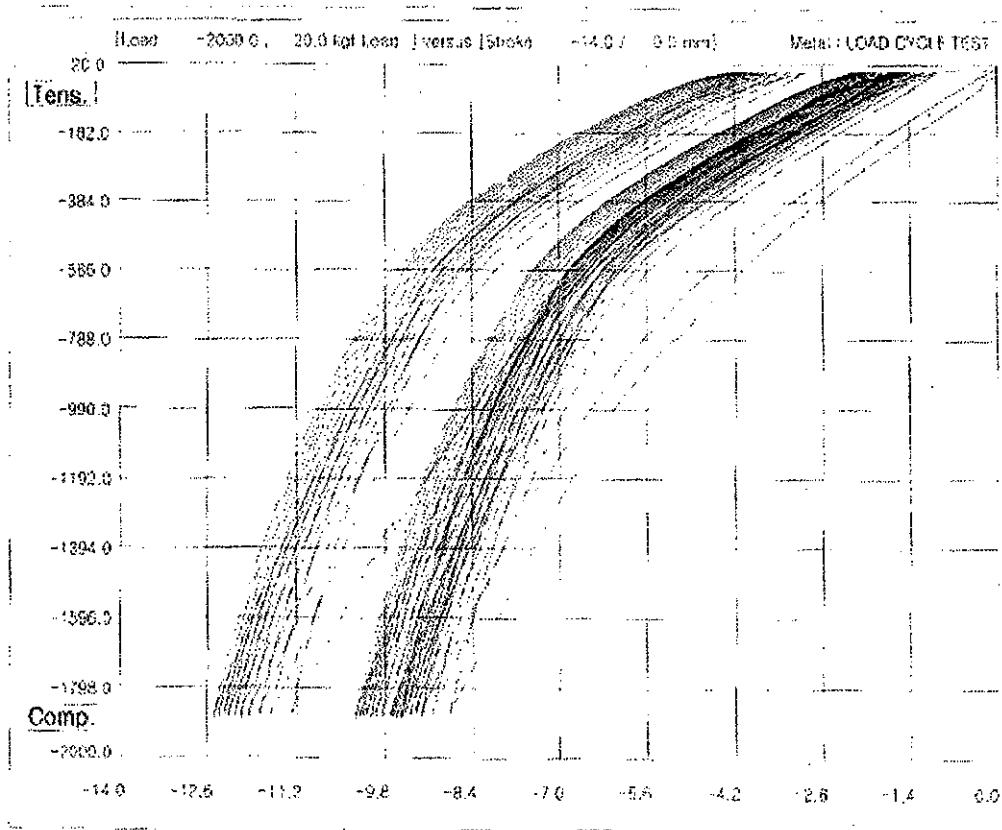
Test Report

File Path:

차종(Car Model)	NB-7	납품처(Customer)	KIA
부품명(Part Name)	RUCA ASSY	요청자(Requester)	총무팀
시험항목(Test Item)	ASSY 강도시험	책임부서(Responsibility)	
시작수(Q'ty)	3 EA	방법(Purpose)	기준기법
평가기준(Criteria)	F=1,862 kgf 每 10회 보류	방법(Test Method)	

NO. & Lot.	Data	방법(Method)		측정(Comp.)		인치(Tens.)	
		속도(Speed)	Unit	속도(Speed)	Unit	속도(Speed)	Unit
1	6	20.0	mm/min	-1886.7	kgf	-12.5	in
2	0	20.0	mm/min	-1888.5	kgf	-9.6	in
3	9	20.0	mm/min	-1890.2	kgf	-10.3	in
Average		20.0	mm/min	-1889.1	kgf	-10.8	in
Unit							

- MEMO -

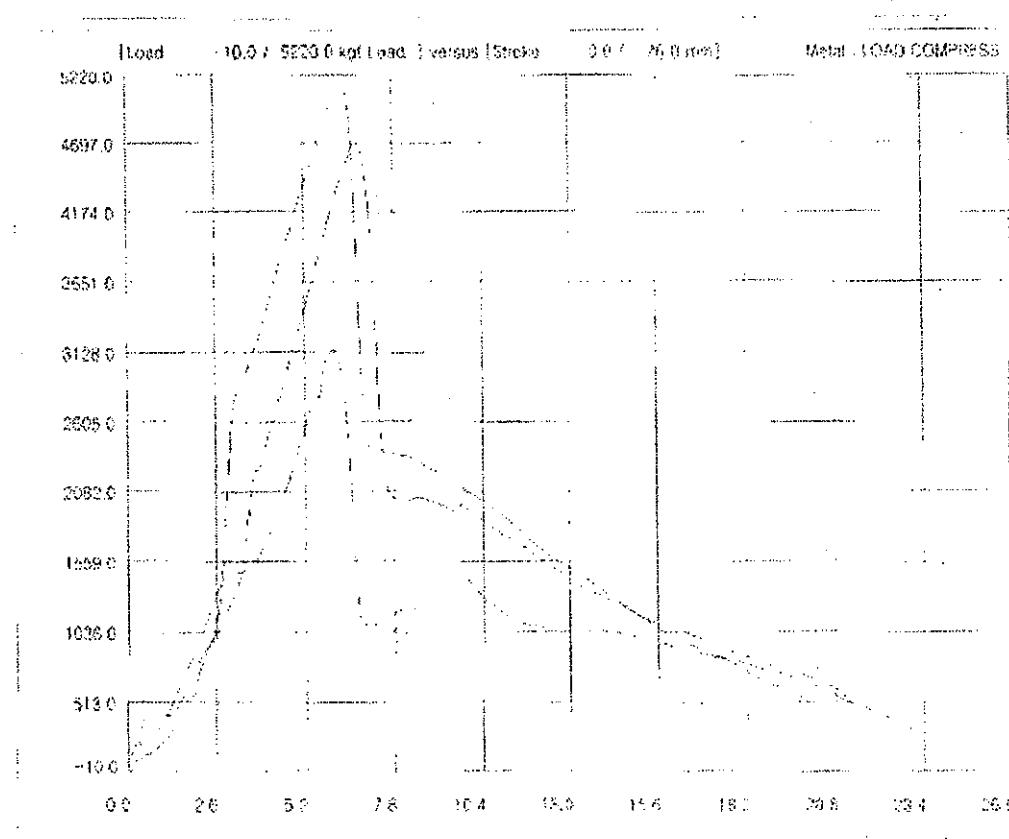


Tester Review Approval

Test Report

File Path:		Customer:	
차종(Car Model)	UPR ARM ASS Y	고객명(Customer)	KMC
부품명(Part Name)	BUSH 뒷좌석 헤드 TEST	제작처(Manufacturer)	제한공
시험항목(Test Item)	3EA	부서(Department)	제작
시작기준(Initial)	MN 1,000 kgf	목적(Purpose)	제작 시험
방법(Test Method)		최고점(Peak P)	
Data	방법(Method)	최고점(Peak P)	단위(Unit)
NO. & Lot.	단위(kgf)	kgf	mm
1	30.0	3155.3	6.0
2	30.0	5180.8	6.3
3	30.0	4701.7	6.7
Average	30.0	4366.9	6.3

- MEMO -



CTR laboratory

TEST REPORT

Tester Review Approval

File Path 내선 카드 file item	제작 품질 관리 평가 시험 (AXIAL AND RADIAL END TRAVEL)								
제작 MANUFACTURER : KMC	제작 번호 MANUFACTURE NO. : NH-7	제작 부위 MANUFACTURE PART : RUMA ASSY							
BOM No.	LOT No.	제작일 MANUFACTURE DATE : 2023.01.10							
<input type="checkbox"/> 개별시험 <input type="checkbox"/> 품종시험 <input type="checkbox"/> 품종평가 <input checked="" type="checkbox"/> 고정점 이동 <input type="checkbox"/> 단면 평평도 <input type="checkbox"/> 평평도 INDIVIDUAL TEST <input type="checkbox"/> GROUPING <input type="checkbox"/> GROUP TEST <input checked="" type="checkbox"/> POSITION MOVEMENT <input type="checkbox"/> SURFACE FLATNESS <input type="checkbox"/> SURFACE FLATNESS RATE TEST		4/15							
수령 일자 RECEIVED DATE : 2023.01.10		1	PCS						
<input type="checkbox"/> SPC <input type="checkbox"/> PPAP <input type="checkbox"/> PROTO (PV) <input type="checkbox"/> PROTO (DW) <input type="checkbox"/> INITIAL SAMPLE									
제작 (제작) 품종 MANUFACTURE EVALUATION									
시험 항목 TEST ITEM	시험 조건 TEST CONDITION	시험 결과 TEST RESULT	단위 UNIT						
Axial Load RADIAL LOAD : 30 kgf	No. 1 No. 2	0.1 mm 0.15 mm	mm						
Axial Load RADIAL LOAD : 200 kgf	No. 3 No. 4	0.1 mm 0.15 mm	mm						
시험 결과 (Test Result)									
A/E (AXIAL END TRAVEL) [mm]				R/E (RADIAL END TRAVEL) [mm]					
No.	Compressive Disp.	Tensile Disp.	Total Disp.	No.	Compressive Disp.	Tensile Disp.	Total Disp.		
1	-0.016	-0.011	0.027	0.017	1	-0.083	-0.235	0.318	0.117
2	-0.015	-0.018	0.029	0.028	2	-0.080	-0.248	0.328	0.119
3	-0.016	-0.019	0.030	0.018	3	-0.089	-0.246	0.337	0.114
4	-0.015	-0.018	0.029	0.028	4	-0.080	-0.248	0.328	0.119
5	-0.016	-0.019	0.030	0.018	5	-0.089	-0.246	0.337	0.114
6	-0.015	-0.018	0.029	0.028	6	-0.080	-0.248	0.328	0.119
7	-0.016	-0.019	0.030	0.018	7	-0.089	-0.246	0.337	0.114
8	-0.015	-0.018	0.029	0.028	8	-0.080	-0.248	0.328	0.119
9	-0.016	-0.019	0.030	0.018	9	-0.089	-0.246	0.337	0.114
10	-0.015	-0.018	0.029	0.028	10	-0.080	-0.248	0.328	0.119
Axial Displacement [mm]				Radial Displacement [mm]					



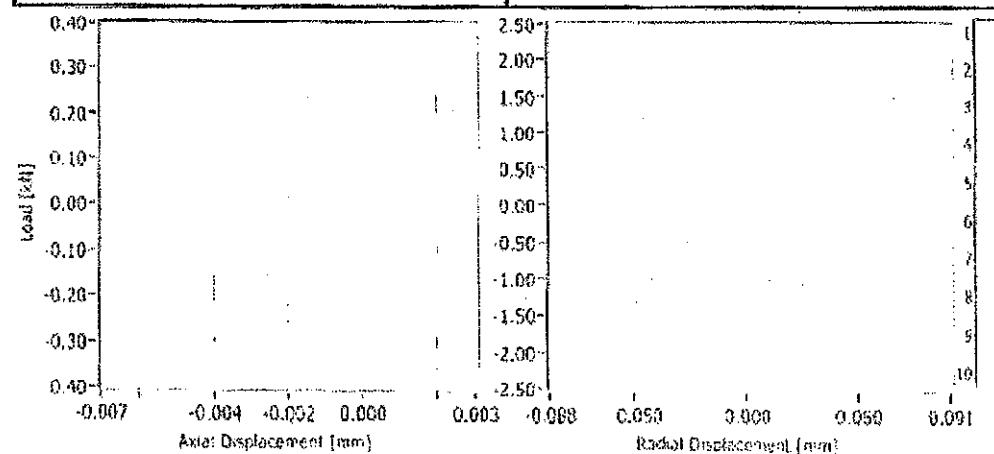
CTR Laboratory

TEST REPORT

Tester Review Approval

File Path							
제작 품목 TEST ITEM	축 및 흐름 유역 성능 시험 (AXIAL AND RADIAL END TRAVEL)						
고객 CUSTOMER	KMC	차종 CAR MODEL	RR-7	부품명 PART NAME	RUCA ASSY		
ROM No.		LOT No.		제작일 REQUESTED	2018-05-08		
시험 목적 TEST PURPOSE	<input type="checkbox"/> 개발 사용 <input type="checkbox"/> 증가 감시 <input type="checkbox"/> 공정 관리 <input checked="" type="checkbox"/> 고정 평가 <input type="checkbox"/> 연구 분석 <input type="checkbox"/> 최종 검증 DEVELOPMENT MONITORING PROCESS POST-TEST RESEARCH DATA <input type="checkbox"/> SOP <input type="checkbox"/> PPAP <input type="checkbox"/> PROTO (PV) <input type="checkbox"/> PROTO (DV) <input type="checkbox"/> INITIAL SAMPLE <input type="checkbox"/> 대체 3 pcs						
제작 (제작) 조건 MANUFACTURING CONDITIONS		검정 조건					
시험 방법 METHOD	축적荷重 AXIAL LOAD	30	kgf	Hz	축적 진동 CRITERIA	0.1	mm
	경적荷重 RADIAL LOAD	200	kgf	Hz	경적 진동 (RADIAL END TRAVEL)	0.15	mm

시험 결과 (Test Result)									
축적 유역 (AXIAL END TRAVEL) [mm]					경적 유역 (RADIAL END TRAVEL) [mm]				
No	Compressive Disp.	Tensile Disp.	Total Disp.	Displacement	No	Compressive Disp.	Tensile Disp.	Total Disp.	Displacement
1	0.001	-0.004	0.005	0.005	1	0.060	0.076	0.136	0.074
2	0.002	-0.007	0.009	0.007	2	0.091	-0.068	0.180	0.091
3	0.003	-0.004	0.007	0.006	3	0.069	-0.071	0.140	0.078
4					4				
5					5				
6					6				
7					7				
8					8				
9					9				
10					10				



CTR Laboratory

Report No : BDKAA5001

Distribution

Test Report

KMC NB-7 Upper Control Arm Ass'y

Part No : OK011 34 200A

Test Purpose	:	Manufacturing Verification Test
Draft Date	:	2001.04.19
Test Date	:	2001.03.08~2001.04.18
Test Location	:	CTR Laboratory
Test Engineers	:	Kyung Min Yeon, Jung Seok Yeon, Young Gil Cho
Drafter	:	Sun Min Seo



Technology Research Center Laboratory

Table of Contents

1 Quality Assurance Chart

2 Test Results

2.1 Performance Test

- 2.1.1 Rotating Maneuver Torque
- 2.1.2 Rotating Function Torque
- 2.1.3 Oscillating Torque
- 2.1.4 End Travel Test

2.2 Strength Test

- 2.2.1 Tensile Load
- 2.2.2 Pressure Load
- 2.2.3 Stud Static Bending Strength
- 2.2.4 Stud Fatigue Bending Strength
- 2.2.5 Stud Fatigue Distortion
- 2.2.6 Stud Free Fall Impact
- 2.2.7 Radial Load
- 2.2.8 Low Temperature Impact Load
- 2.2.9 Assy Load
- 2.2.10 Bush Separation

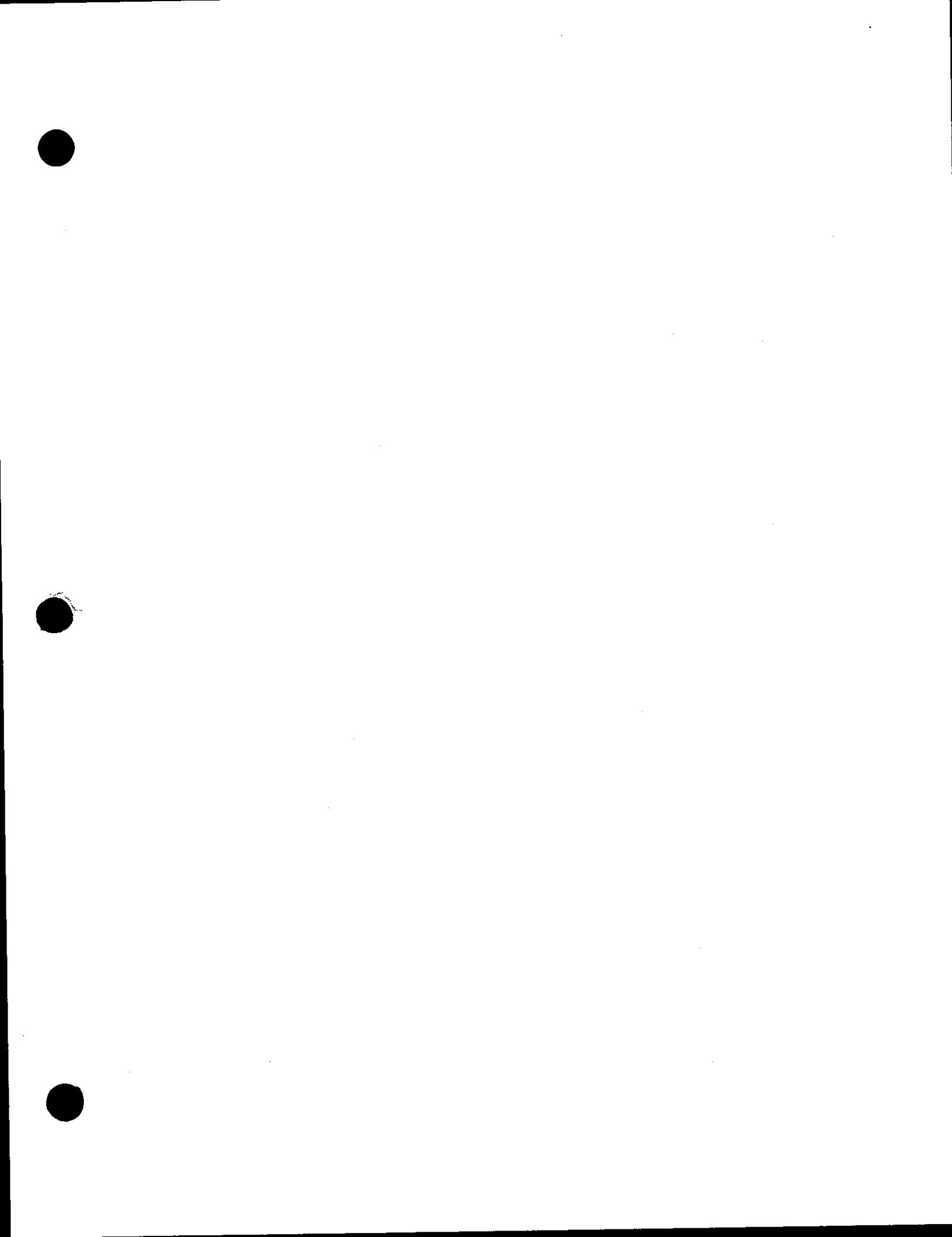
2.3 Durability Test

- 2.3.1 Wear and Tear Durability
- 2.3.2 Reflection Durability

2.4 Seal Test

- 2.4.1 Climatic Test
- 2.4.2 Low Temperature Seal Test

3 Test Methods



Report No : BDKAA5001

배포처

Test Report

KMC NB-7 Upper Control Arm Ass'y

Part No : OK011 34 200A

시험 목적	:	양산 확인 시험
작성일	:	2001.04.19
시험 기간	:	2001.03.08~2001.04.18
시험 장소	:	CTR 시험실
시험자	:	윤경민, 윤정석, 조영길
작성자		서선민



기술연구소 시험실

목 차

1 품질보증표

2 시험결과

2.1 성능시험

- 2.1.1 회전 기동 Torque
- 2.1.2 회전 작동 Torque
- 2.1.3 동 Torque
- 2.1.4 유격

2.2 강도시험

- 2.2.1 인발
- 2.2.2 압발
- 2.2.3 Stud 정적 굽힘
- 2.2.4 Stud 피로 굽힘
- 2.2.5 Stud 피로 비틀림
- 2.2.6 Stud 낙하 충격
- 2.2.7 형방향 대하중
- 2.2.8 저온 충격 하중
- 2.2.9 Ass'y 대하중
- 2.2.10 Bush 빠짐

2.3 내구시험

- 2.3.1 마모 내구
- 2.3.2 굴절 내구

2.4 Seal시험

- 2.4.1 내후성
- 2.4.2 저온 Seal성

3 시험방법

품질보증부
차종 : NB-7
부품명 : Upper Control Arm Ass'y

도면번호 : OK011 34 210
업체번호 : 2001.03.20

남 품업체 : 케센트럴
(설시부서 : 기술연구소 시험실)

시험분류	No.	시험항목	시험방법 및 조건	평가기준	수량	시험결과	판정	일정	
성능시험	1	회전기동 Torque	작동상태 없이 상온에서 24kgf 방지 후, 측정.	180 kgf.cm 이하	n=3	No.01 75 kgf.cm No.02 72 kgf.cm No.03 62 kgf.cm	OK	2001.03.20	
	2	회전작동 Torque	20°C에서 ±30° 회전 1회, ±15°회전 5회 후, 안정된 회전 Torque 측정.	10 ~ 30 kgf.cm	n=3	No.01 18.53 kgf.cm No.02 14.76 kgf.cm No.03 23.03 kgf.cm	OK	2001.03.20	
	3	동Torque	±5°, 12Hz Torque 측정.	회전 작동 Torque 의 10% 이상	n=3	No.01 43.87 kgf.cm No.02 37.79 kgf.cm	237% 260% 164%	OK	2001.03.20
	4	류각	Ball Stud 축방향으로 250 kgf의 하중을 가한 후, 범위량을 측정.	0.22 mm 이하	n=3	No.01 0.057 mm No.02 0.059 mm No.03 0.059 mm	OK	2001.03.20	
강도시험		Ball Stud 철봉방향으로 500 kgf의 하중을 가한 후, 범위량을 측정.	0.23 mm 이하	n=3	No.01 0.226 mm No.02 0.221 mm No.03 0.220 mm	OK	2001.03.20		
	5	인발	Ball Stud 축방향으로 인장하중을 가하여 Socket으로부터 Ball Stud를 이탈.	3,000 kgf 이상	n=3	No.01 3501.1 kgf No.02 3421.9 kgf No.03 3496.5 kgf	OK	2001.03.22	
	6	암발	Ball Stud 축방향으로 압축하중을 가하여 Socket으로부터 Ball Stud를 이탈.	1,500 kgf 이상	n=3	No.01 2398.4 kgf No.02 2507.5 kgf No.03 2747.9 kgf	OK	2001.03.22	
	7	Stud 정착 금속	Stud에 정착 금속 하중 2300kgf 을 부착.	Ball Stud 파손 및 균열 없을 것.	n=3	No.01 ~ 03	Ball Stud 파손 및 균열 없음.	OK	2001.03.22
	8	Stud 파로 금속	Stud에 파로 금속 하중을 부착.	파로 파고 없을 것.	n=3	No.01 ~ 03	OK	2001.03.22	
	9	Stud 파로 봉틀립	100~120kgf x 700rpm x 1,000,000회 Stud에 파로 봉틀립 하중을 부착.	파로 파고 없을 것.	n=2	No.01 ~ 02	파로 파고 없음.	OK	~2001.03.27
10	Stud 낙하 충격	Stud에 50kgf 의 주저구하치시 12kgf.m 의 충격 하중을 부착.	변형량 2.1mm 이하.	n=3	No.01 1.79 mm No.02 1.90 mm No.03 1.74 mm	OK	2001.03.27		
	11	횡방향 대하중	37°C에서 Assy에 Stud의 횡방향으로 3000kgf 의 하중을 부착.	Ball Joint 에 파손 없을 것.	n=2	No.01 ~ 02	Ball Joint 에 파손 없음.	OK	2001.03.31
	12	서온 충격	-35°C에서 Assy에 Stud의 횡방향으로 2500kgf 의 충격 하중을 10회 부착.	Ball Joint 에 파손 없을 것.	n=2	No.01 ~ 02	Ball Joint 에 파손 없음.	OK	2001.04.02
	13	Ass'y 대하중	Ass'y 상단에서 Stud에 아래의 하중을 10회 부착. 차량 전후 방향 : 866 kgf 차량 내측 방향 : 1528 kgf 차량 수직 방향 : 560 kgf	Arm 부에 변형 없을 것.	n=3	No.01 ~ 03	Arm 부에 변형 없음.	OK	2001.03.22
14	Bush 빠짐	Bush 축 방향으로 30mm/분으로 압발하중을 부하하여 Bush 이탈.	1,000 kgf 이상	n=3	No.01 3155.3 kgf No.02 5180.8 kgf No.03 4701.7 kgf	OK	2001.03.27		
		시험방법 및 조건	평가기준	수량		시험결과	판정	일정	
시험분류	No.	시험항목	시험방법 및 조건	평가기준	수량	시험결과	판정	일정	

2 시험 결과

2.1 성능시험

- 2.1.1 회전 기동 Torque
- 2.1.2 회전 작동 Torque
- 2.1.3 동 Torque
- 2.1.4 유격

2.2 강도시험

- 2.2.1 인발
- 2.2.2 압발
- 2.2.3 Stud 정적 굽힘
- 2.2.4 Stud 피로 굽힘
- 2.2.5 Stud 피로 비틀림
- 2.2.6 Stud 낙하 충격
- 2.2.7 횡방향 대하중
- 2.2.8 저온 충격 하중
- 2.2.9 Ass'y 대하중
- 2.2.10 Bush 빠짐

2.3 내구시험

- 2.3.1 마모 내구
- 2.3.2 굴절 내구

2.4 Seal 시험

- 2.4.1 내후성
- 2.4.2 저온 Seal성

2.1 성능 시험

2.1.1 회전 기동 Torque

2.1.1.1 시험 방법

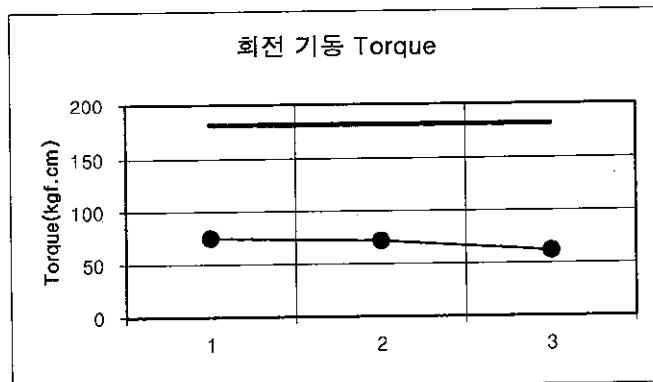
작동상태 없이 상온에서 24hr 방치 후, 측정.

2.1.1.2 평가 기준

180 kgf.cm 이하

2.1.1.3 시험 결과

No	Torque (kgf.cm)
1	75.0
2	72.0
3	62.0
평균	69.7
편차	6.8



2.1.2 회전 작동 Torque

2.1.2.1 시험 방법

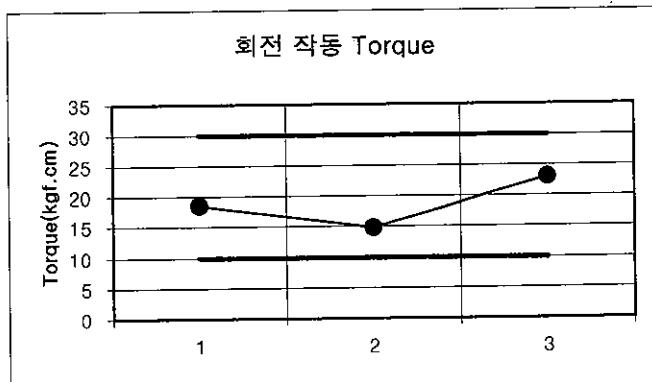
20°C에서 ±30° 회전 1회, ±15°회전 5회 후, 안정된 회전 Torque 측정.

2.1.2.2 평가 기준

10 ~ 30 kgf.cm

2.1.2.3 시험 결과

No	Torque (kgf.cm)
1	18.53
2	14.76
3	23.03
평균	18.77
편차	4.14



2.1.3 동 Torque

2.1.3.1 시험 방법

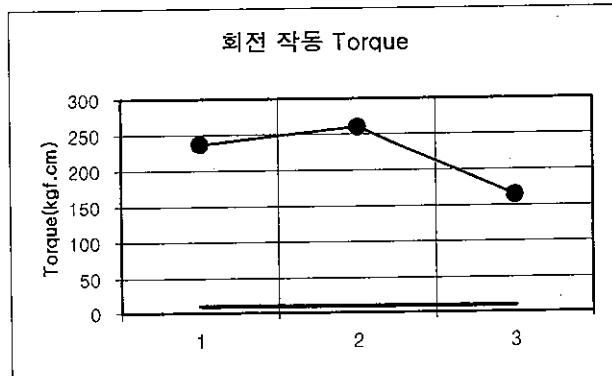
$\pm 5^\circ$, 12Hz Torque 측정.

2.1.3.2 평가 기준

회전 작동 Torque 의 10% 이상

2.1.3.3 시험 결과

No	Torque (kgf.cm)	변화량 (%)
1	43.87	237
2	38.33	260
3	37.79	164
평균	40.00	220
편차	3.37	50



2.1.4 유격

2.1.4.1 시험 방법

Ball Stud 축방향 유격

Ball Stud 축방향으로 250 kgf의 하중을 가한 후, 변위량을 측정.

Ball Stud 횡방향 유격

Ball Stud 횡방향으로 500 kgf의 하중을 가한 후, 변위량을 측정.

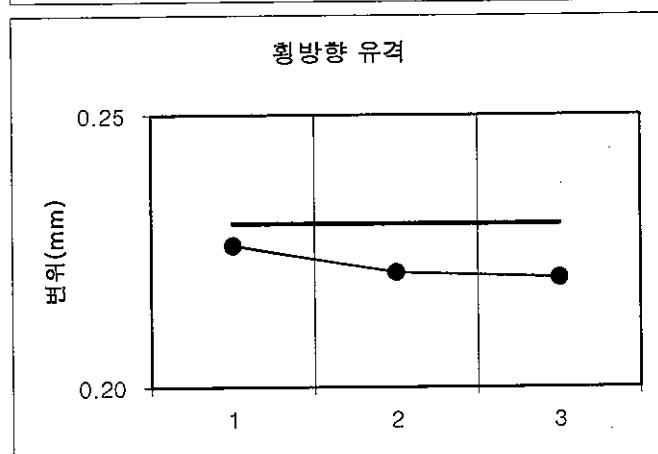
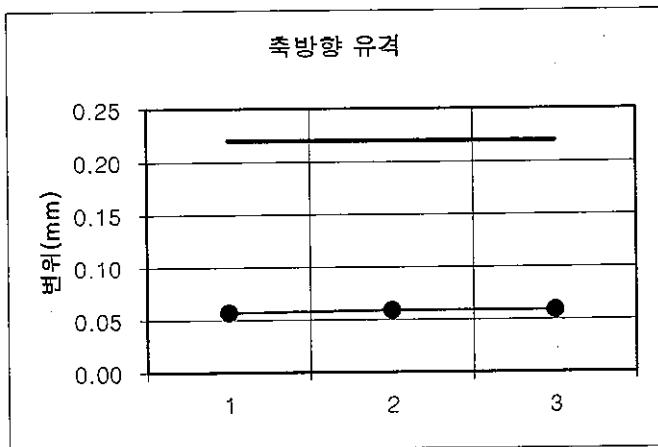
2.1.4.2 평가 기준

Ball Stud 축방향 유격 : 0.22 mm 이하

Ball Stud 횡방향 유격 : 0.23 mm 이하

2.1.4.3 시험 결과

No	유격(mm)	
	축방향	횡방향
1	0.057	0.226
2	0.059	0.221
3	0.059	0.220
평균	0.058	0.222
편차	0.001	0.003



2.2 강도 시험

2.2.1 인발

2.2.1.1 시험 방법

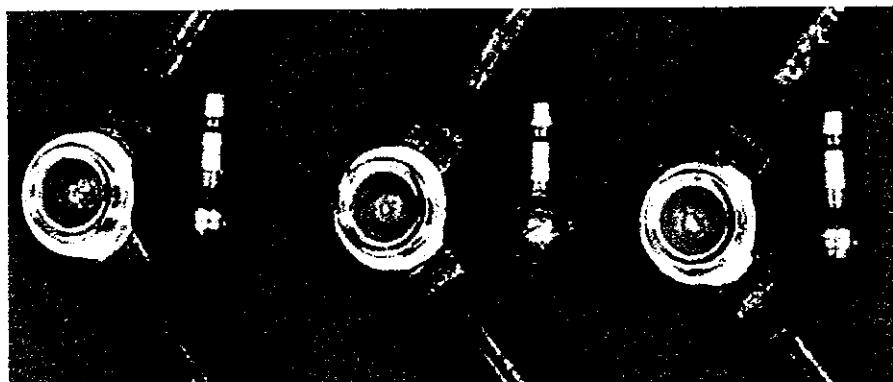
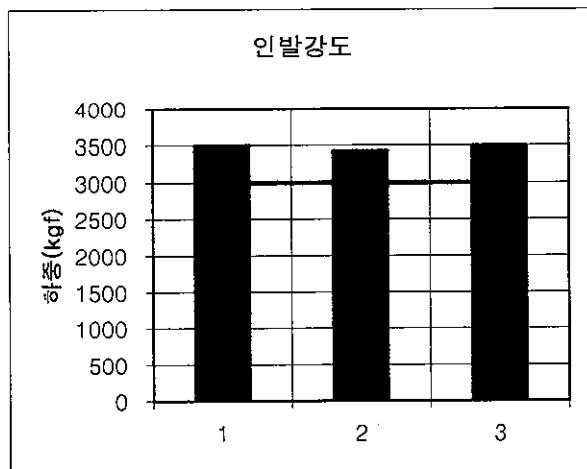
Ball Stud 축방향으로 인장하중을 가하여 Socket으로부터 Ball Stud를 이탈.

2.2.1.2 평가 기준

3,000 kgf 이상

2.2.1.3 시험 결과

No	인발하중 (kgf)
1	3501.1
2	3421.9
3	3496.5
평균	3473.2



2.2.2 압발

2.2.2.1 시험 방법

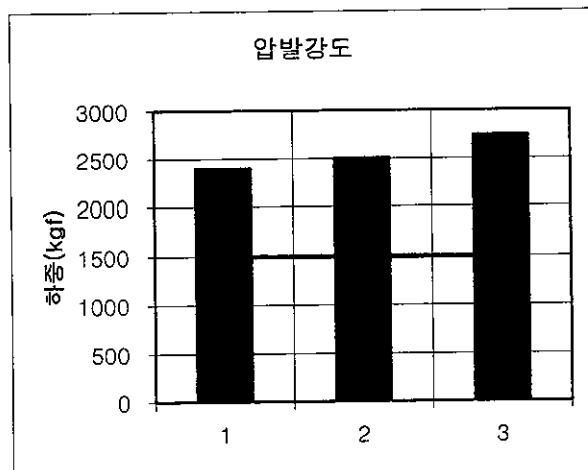
Ball Stud 축방향으로 압축하중을 가하여 Socket으로부터 Ball Stud를 이탈.

2.2.2.2 평가 기준

1,500 kgf 이상

2.2.2.3 시험 결과

No	압발하중 (kgf)
1	2398.4
2	2507.5
3	2747.9
평균	2551.3



2.2.3 Stud 정적 굽힘

2.2.3.1 시험 방법

Stud에 정적 굽힘 하중 2300kgf 을 부하.

2.2.3.2 평가 기준

Ball Stud 파손 및 균열 없을 것.

2.2.3.3 시험 결과

No	시 험 결 과
1	Ball Stud 파손 및 균열 없음.
2	Ball Stud 파손 및 균열 없음.
3	Ball Stud 파손 및 균열 없음.



2.2.4 Stud 피로 굽힘

2.2.4.1 시험 방법

Stud에 피로 굽힘 하중을 부하.
100~1200kgf x 700cpm x 1,000,000회

2.2.4.2 평가 기준

피로 파괴 없을 것.

2.2.4.3 시험 결과

No	시험 결과
1	피로 파괴 없음.
2	피로 파괴 없음.
3	피로 파괴 없음.



2.2.5 Stud 피로 비틀림

2.2.5.1 시험 방법

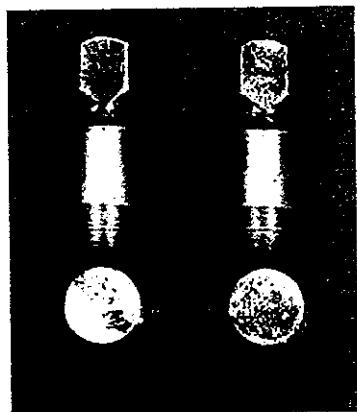
Stud에 피로 비틀림 하중을 부하.
 $\pm 1200\text{kgf.cm} \times 700\text{cpm} \times 1,000,000\text{회}$

2.2.5.2 평가 기준

피로 파괴 없을 것.

2.2.5.3 시험 결과

No	시험 결과
1	피로 파괴 없음.
2	피로 파괴 없음.



2.2.6 Stud 낙하 충격

2.2.6.1 시험 방법

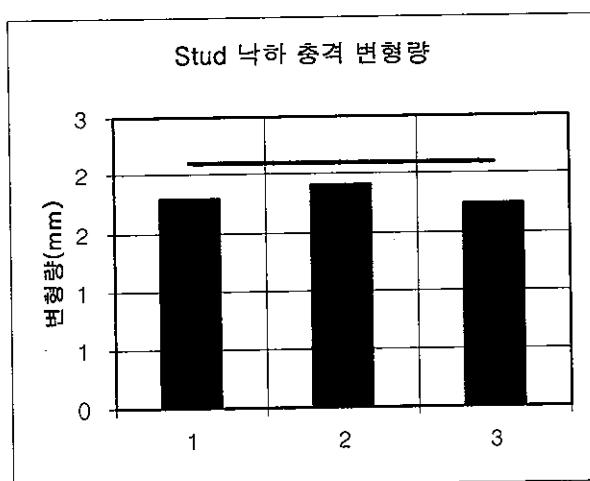
Stud에 50kgf 의 추를 자유낙하시켜 12kgf.m 의 충격 하중을 부하.

2.2.6.2 평가 기준

변형량 2.1mm 이하.

2.2.6.3 시험 결과

No	변형량 (mm)
1	1.79
2	1.90
3	1.74
평균	1.81



2.2.7 횡방향 대하중

2.2.3.1 시험 방법

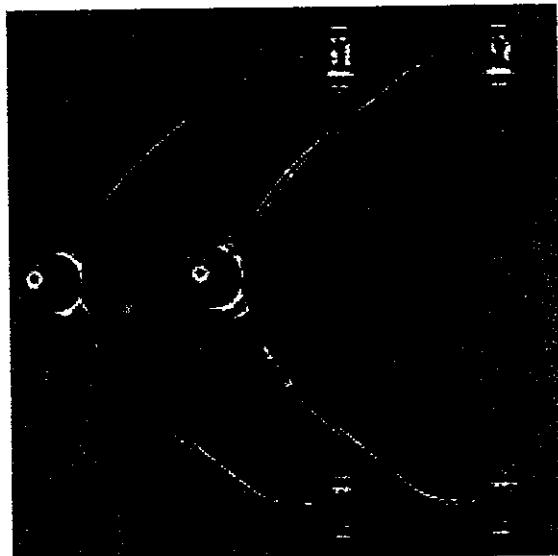
37°C에서 Ass'y에 Stud의 횡방향으로 3000kgf의 하중을 부하.

2.2.3.2 평가 기준

Ball Joint에 파손 없을 것.

2.2.3.3 시험 결과

No	시험 결과
1	Ball Joint에 파손 없음.
2	Ball Joint에 파손 없음.



2.2.8 저온 충격

2.2.8.1 시험 방법

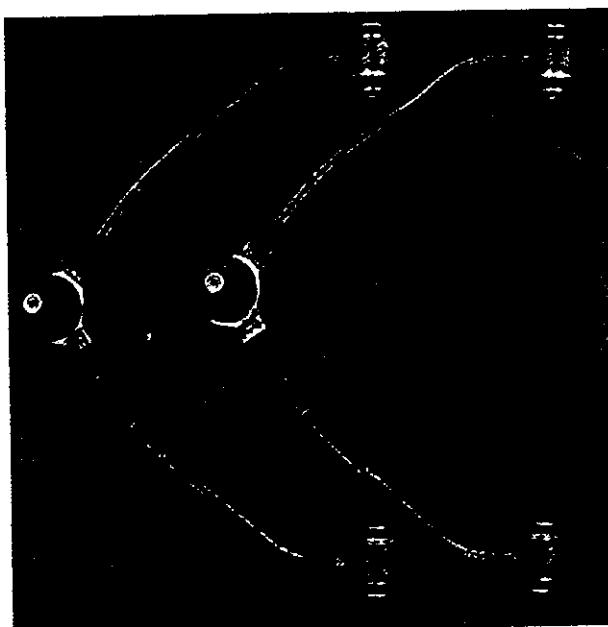
-35°C에서 Ass'y에 Stud의 횡방향으로 2500kgf의 충격하중을 10회 부하.

2.2.8.2 평가 기준

Ball Joint에 파손 없을 것.

2.2.8.3 시험 결과

No.	시험 결과
1	Ball Joint에 파손 없음.
2	Ball Joint에 파손 없음.



2.2.9 Ass'y 대하중

2.2.9.1 시험 방법

Ass'y 상태에서 Stud에 아래의 하중을 10회 부하.

차량 전후 방향 : 886 kgf

차량 내측 방향 : 1528 kgf

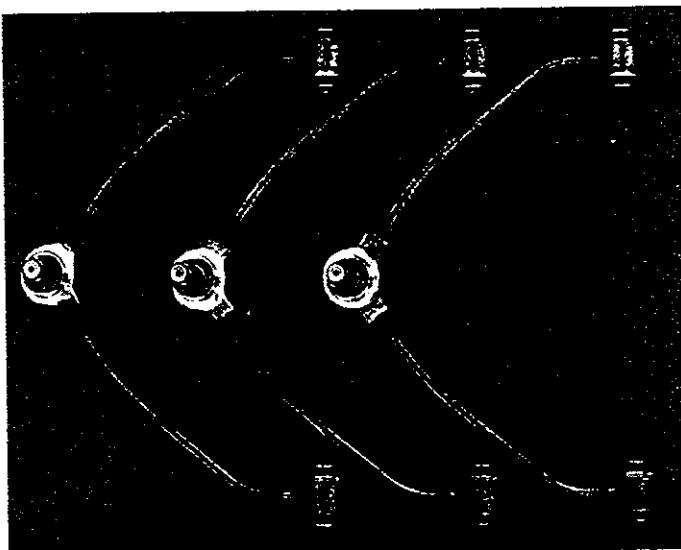
차량 수직 방향 : 590 kgf

2.2.9.2 평가 기준

Arm 부에 변형 없을 것.

2.2.9.3 시험 결과

No	시험 결과
1	Arm 부에 변형 없음.
2	Arm 부에 변형 없음.
3	Arm 부에 변형 없음.



2.2.10 Bush 빠짐

2.2.10.1 시험 방법

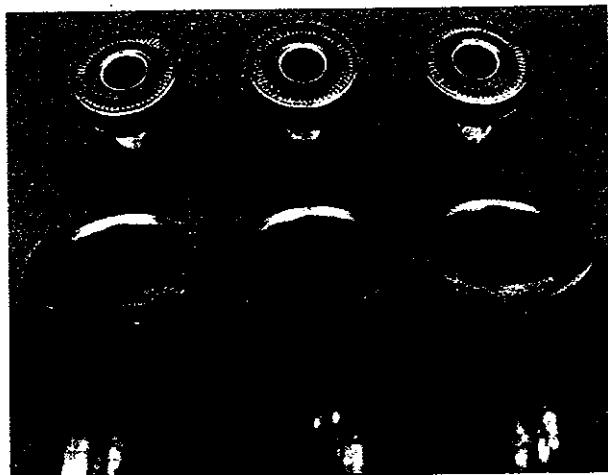
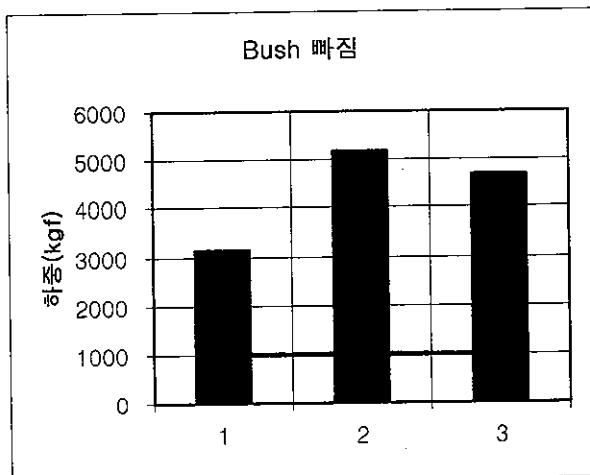
Ball Stud 축방향으로 인장하중을 가하여 Socket으로부터 Ball Stud를 이탈.

2.2.10.2 평가 기준

1,000 kgf 이상

2.2.10.3 시험 결과

No	인발하중 (kgf)
1	3155.3
2	5180.8
3	4701.7
평균	4345.9



2.3 내구 시험

2.3.1 마모·내구

2.3.1.1 시험 방법

No	Ball Stud			온도	반복속도 (Hz)	하중반복횟수 (Cycle)	분위기
	요동각(°)	회전각(°)	횡하중(kgf)				
1	±7°	-	±450	상온	2~3	300,000	니수 JIS8종
2	±15°	±30°	±750		1~1.5	150,000	
3	±15°	±30°	±1,100		1~1.5	50,000	
4	±7°	-	±450		2~3	3,000	건조
5	±3°	-	±250		6~12	2,200,000	
6	±15°	±30°	±750		1~1.5	3,000	니수 JIS8종

2.3.1.2 평가 기준

내구 후,
축유격 : 0.1mm / 30kgf
횡유격 : 0.15mm / 200kgf
회전 Torque : 1kgf.cm 이상

Dust cover 파괴 없을 것.
Stud 균열, 변형 없을 것.
내부부품 손상 없을 것.
잔존 Grease 이상 없을 것.

2.3.1.3 시험 결과

No	내구후		
	축유격 (mm)	횡유격 (mm)	Torque (kgf.cm)
1	0.017	0.117	4.40
2	0.019	0.119	2.40
3	0.018	0.114	3.70

Ball Stud

No.1



No.2



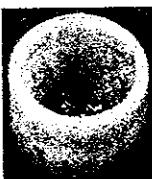
No.3



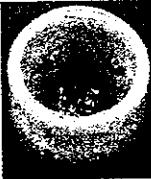
Ball Stud에 Crack 및 변형 없음.

Ball Seat

No.1



No.2



No.3

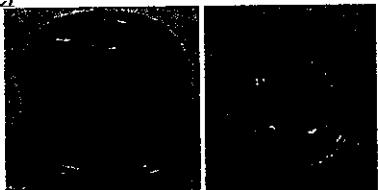


Ball Seat에 Crack 및 변형 없음.

Ball Seat 현저한 마모 없음.(육안검사).
Bearing 작동면에 Grease가 존재하며 변색됨.

Dust Cover

No.1



No.2



Dust Cover에 Crack 및 변형 없음.
내부에 달인 흔적은 있으나 찢어짐 현상은 없음.
Grease가 외부로 새어 나온 흔적이 없음.

2.3.2 굴절 내구

2.3.2.1 시험 방법

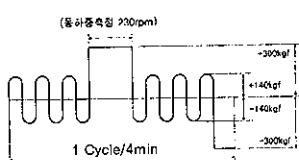
요동 : $\pm 15^\circ \times 1.2 \text{ Hz} \times 500,000$

회전 : $\pm 30^\circ \times 1.2 \text{ Hz}$

분위기 : 니수 JIS 8종(1분/10분), 상온

횡하중(정하중) : $\pm 300\text{kgf}$

횡하중(동하중) : $\pm 140\text{kgf}$



2.3.2.2 평가 기준

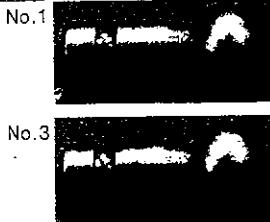
내구 후, 축유격 : 0.1mm / 30kgf
환유격 : 0.15mm / 200kgf
회전 Torque : 1kgf.cm 이상

Dust cover 파괴 없을 것.
Stud 균열, 변형 없을 것.
내부부품 손상 없을 것.
잔존 Grease 이상 없을 것.

2.3.2.3 시험 결과

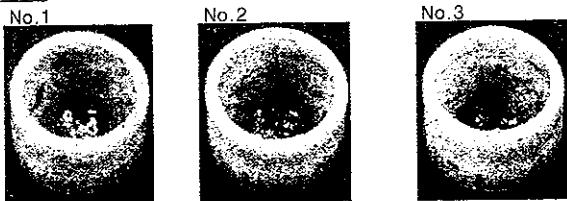
No	내구후		
	축유격 (mm)	환유격 (mm)	Torque (kgf.cm)
1	0.005	0.074	26.4
2	0.007	0.091	30.4
3	0.006	0.078	31.7

Ball Stud



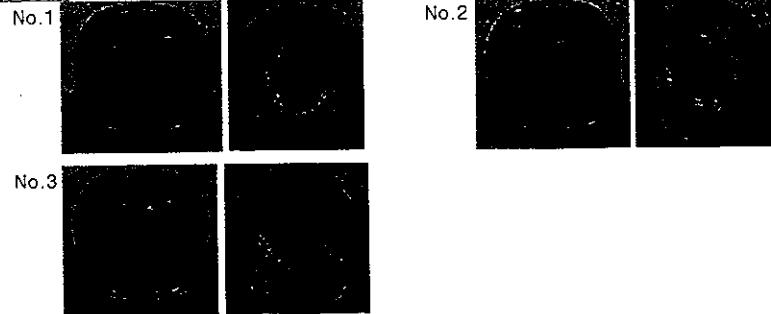
Ball Stud에 Crack 및 변형 없음.

Ball Seat



Ball Seat에 Crack 및 변형 없음.
Ball Seat 현저한 마모 없음.(육안검사).
Bearing 작동면에 Grease가 존재하며 변색됨.

Dust Cover



Dust Cover에 Crack 및 변형 없음.
내부에 끌인 흔적은 있으나 끊어짐 현상은 없음.
Grease가 외부로 새어 나온 흔적이 없음.

2.4 Seal 시험

2.4.1 내후성

2.4.1.1 시험 방법

Ball joint의 Stud를 최대 요동각상태로 하며, ASTM-D1117-68에 준한 Ozone에 노출.

2.4.1.2 평가 기준

72 시간 후, Dust cover 에 균열 및 이상 변화 없을 것.

2.4.1.3 시험 결과

No	시 험 결 과
1	72 시간 후, Dust cover 에 균열 및 이상 변화 없음.
2	72 시간 후, Dust cover 에 균열 및 이상 변화 없음.
3	72 시간 후, Dust cover 에 균열 및 이상 변화 없음.



2.4.2 저온 Seal 성

2.4.2.1 시험 방법

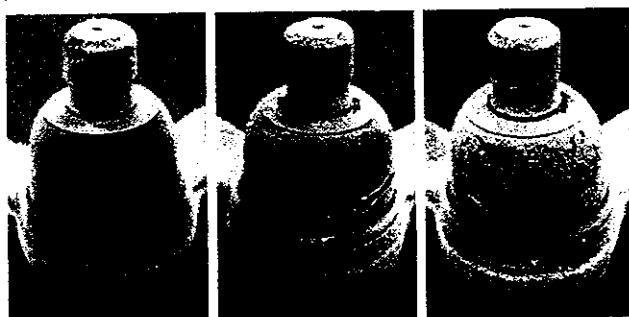
-35℃에서 수회 전작동(요동/회전)시킬 것.

2.4.2.2 평가 기준

완전 Seal성 유지할 것.

2.4.2.3 시험 결과

No	시험 결과
1	완전 Seal성 유지
2	완전 Seal성 유지
3	완전 Seal성 유지



3 시 험 방 법



그림.1 회전 기동 Torque

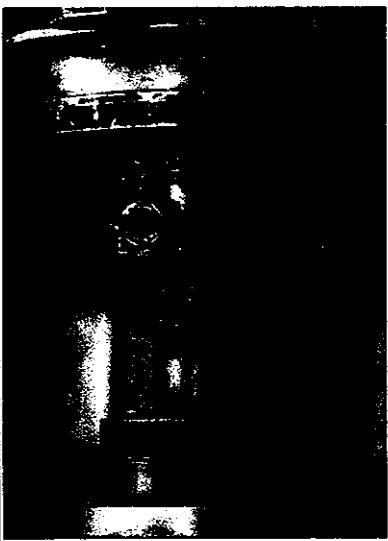


그림.2 회전 작동 Torque

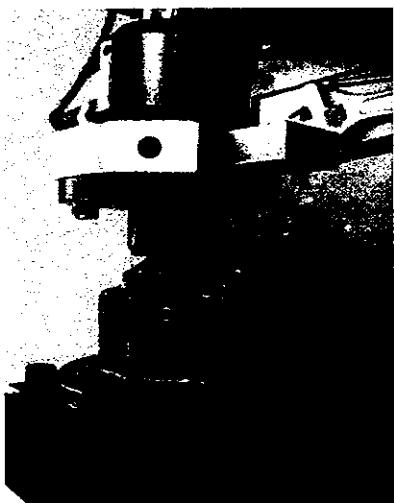


그림.3 측방향 유격

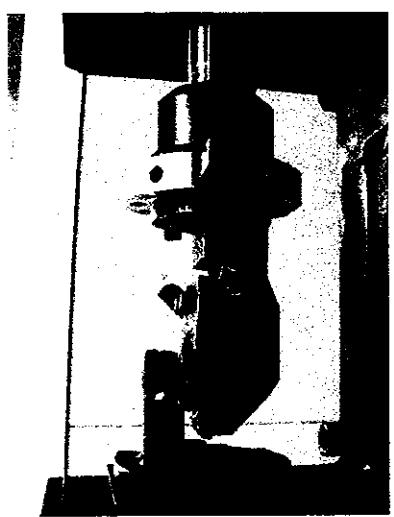


그림.4 횡방향 유격



그림.5 인발

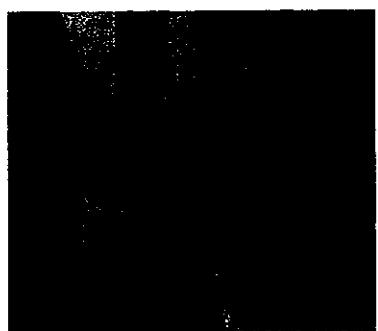
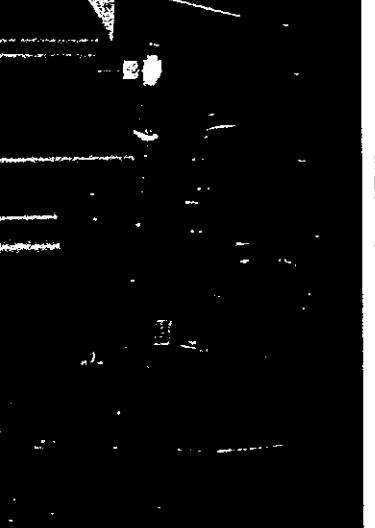
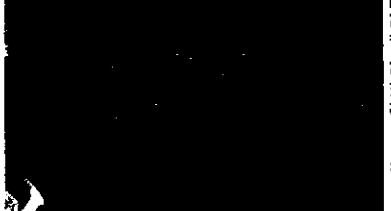


그림.6 인발

 <p>그림.7 Stud 정착 금형</p>	 <p>그림.8 Stud 파로 금형</p>	 <p>그림.10 Stud 낚는 충격</p>
 <p>그림.9 Stud 파로 페틀림</p>	 <p>그림.11 청방향 대처증</p>	 <p>그림.12 저온 충격 허증</p>

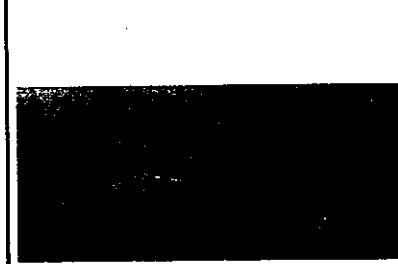


그림.13 Assy 대화중



그림.14 Bush 빠짐

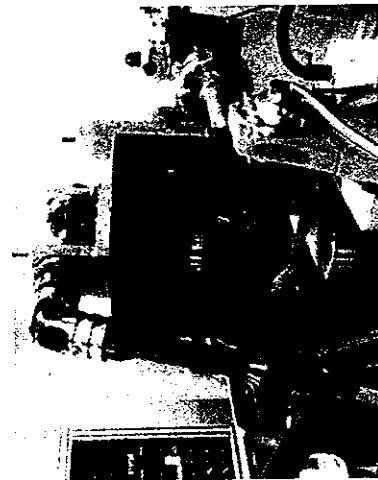
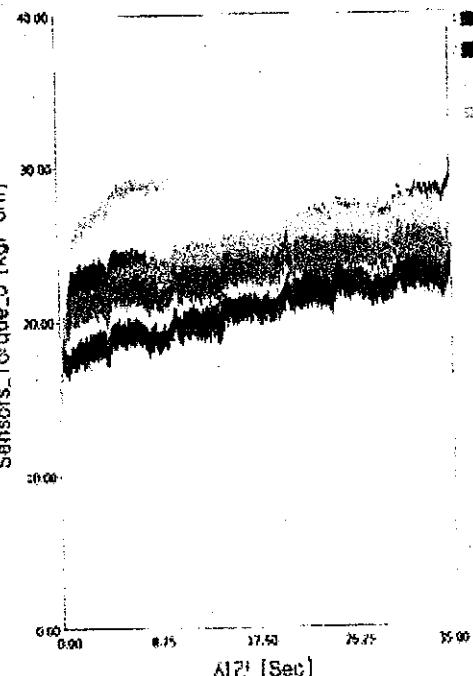
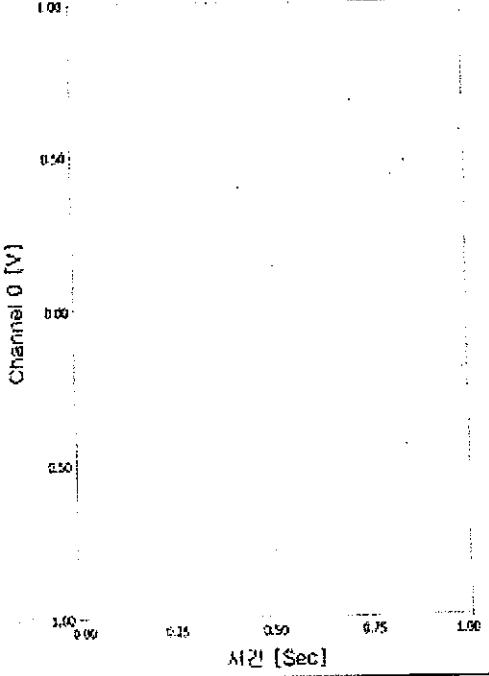


그림.15 마모내구 / 굴절내구

Test Report

Tester	Review	Approval

File Path						
시험 항목 (TEST ITEM)	회전 및 요동 TORQUE 성능 시험 (ROTATING AND OSCILLATING TORQUE)					
업체 (CUSTOMER)	KMC	차종 (CAR MODEL)	NB-7	품명 (PART NAME)	RUCA ASSY	
BOM No.		Lot No.		요청자 (REQUESTER)	총봉길	
시험 목적 TEST PURPOSE	<input checked="" type="checkbox"/> 개발시험 <input type="checkbox"/> 절기점검 <input type="checkbox"/> 공정점검 <input type="checkbox"/> 고장분석 <input type="checkbox"/> 연구분석 <small>(DEVELOPMENT MONITORING PROCESS POST-TEST RESEARCH)</small> <input type="checkbox"/> SOP <input type="checkbox"/> PPAP <input type="checkbox"/> PROTO (PV) <input type="checkbox"/> PROTO (DV) <input type="checkbox"/> INITIAL SAMPLE					사용일 (DATE)
						4/18
						시료수 (QNTY)
						6 pcs
조립 (제작) 조건 (MANUFACTURING CONDITION)						
시험 방법 (METHOD)	2 cycle	720 deg	3 RPM	평가 기준 (CRITERIA)	10~30 kgf.cm	
시험 결과 (TEST RESULTS)						
회전 TORQUE (ROTATING TORQUE) [Kgf.cm]				요동 TORQUE (OSCILLATING TORQUE) [N-m]		
No. 1	18.53	No. 6	27.23	No. 1		No. 6
2	14.76	7		2		7
3	23.03	8		3		8
4	22.02	9		4		9
5	27.57	10		5		10
Sensors_Torque_O [kgf-cm]						
시간 [Sec]	0.00	0.75	1.50	2.25	3.00	3.75
시간 [Sec]	0.00	0.15	0.30	0.45	0.60	0.75

CTR CTR Laboratory

Test Report

Tester	Review	Approval

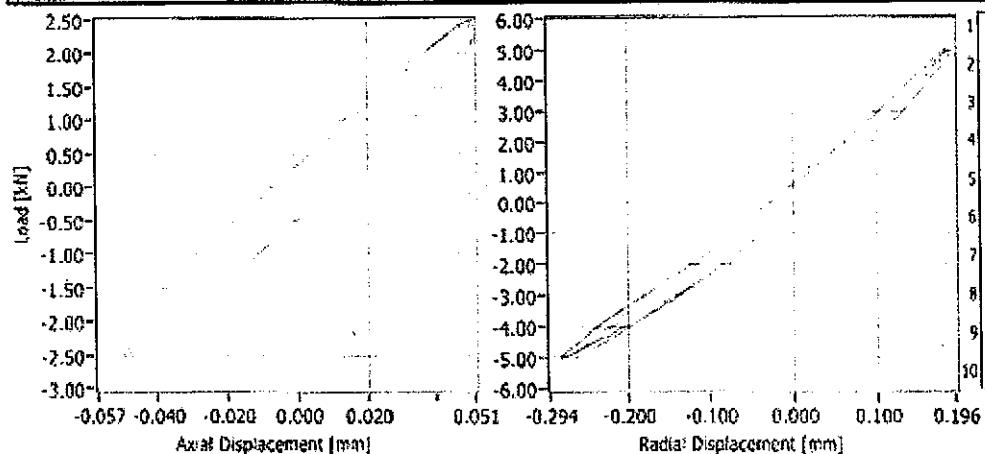
File Path						
시험 항목 TEST ITEM	회전 및 요동 TORQUE 성능 시험 (ROTATING AND OSCILLATING TORQUE)					
업체 CUSTOMER	KMC	차종 (CAR MODEL)	NB-7	품명 (PART NAME)	RUCA ASSY	
BOM No.		Lot No.		의뢰자 (REQUESTER)	총봉길	
시험 목적 TEST PURPOSE	<input checked="" type="checkbox"/> 개발시험 <input type="checkbox"/> 정기검사 <input type="checkbox"/> 공장경사 <input type="checkbox"/> 고품분석 <input type="checkbox"/> 연구분석 <small>(DEVELOPMENT MONITORING PROCESS POST-TEST RESEARCH)</small>					시험일 (DATE)
	<input type="checkbox"/> SOP <input type="checkbox"/> PPAP <input type="checkbox"/> PROTO(PV) <input type="checkbox"/> PROTO(DV) <input type="checkbox"/> INITIAL SAMPLE					시료수 (QNTY)
조합 (제작) 조건 (MANUFACTURING CONDITION)						
시험 방법 METHOD	2 cycle	±5 deg	12Hz	평가기준 (CRITERIA)	회전T.Q의 10%이상	
시험 결과 (TEST RESULTS)						
요동 TORQUE (OSCILLATING TORQUE) [kgf.cm]			요동 TORQUE (OSCILLATING TORQUE) [N·m]			
No. 1	43.87	No. 6		No. 1		No. 6
2	38.33	7		2		7
3	37.79	8		3		8
4		9		4		9
5		10		5		10
Sensors_Torque_O [kgf-cm]				Channel O [v]		
시간 [Sec]	0.00	0.05	0.10	0.15	0.20	0.25
시간 [Sec]	0.00	0.25	0.50	0.75	1.00	

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TEST REPORT

Tester Review Approval

File Path								
시험 항목 (TEST ITEM)								
제조사 (CUSTOMER)		차종 (CAR MODEL)						
KMC		HB-7						
품명 (PART NAME)								
RUCA ASSY								
인회자 (REQUESTER)								
총 통장								
BOM No.								
LOT NO.								
<input type="checkbox"/> 개발시험 <input type="checkbox"/> 정기점검 <input type="checkbox"/> 공정검사 <input checked="" type="checkbox"/> 고정분석 <input type="checkbox"/> 연구분석 사용일 (DEVELOPMENT) (MONITORING) (PROCESS) (POST-TEST) (RESEARCH) (DATE)								
3/20								
시험 목적 (TEST PURPOSE)								
<input type="checkbox"/> SOP <input type="checkbox"/> PPAP <input type="checkbox"/> PROTO (PV) <input type="checkbox"/> PROTO (DV) <input type="checkbox"/> INITIAL SAMPLE 시료수 (SOP) (PPAP) (PROTO (PV)) (PROTO (DV)) (INITIAL SAMPLE) (COUNT)								
6 PCS								
조건 (제작) 조건 (MANUFACTURING CONDITION)								
증가 성능								
시험 방법 (METHODS)	축 하중 (AXIAL LOAD)	250 kgf	H ₂					
	증가 조건 (CRITERIA)		증가 조건 (CRITERIA)					
	축 하중 (RADIAL LOAD)	500 kgf	H ₂					
			증가 조건 (RADIAL END TRAVEL)					
증 유격 (AXIAL END TRAVEL) mm								
증 유격 (RADIAL END TRAVEL) mm								
No	Compressive Disp.	Tensile Disp.	Total Displ.	No	Compressive Disp.	Tensile Disp.	Total Displ.	Displacement
1	0.051	-0.044	0.095	1	0.190	-0.294	0.485	0.226
2	0.047	-0.050	0.097	2	0.193	-0.281	0.473	0.221
3	0.051	-0.055	0.106	3	0.187	-0.283	0.470	0.220
4	0.051	-0.048	0.099	4	0.196	-0.283	0.478	0.227
5	0.049	-0.051	0.100	5	0.185	-0.265	0.449	0.216
6	0.050	-0.057	0.107	6	0.187	-0.270	0.456	0.225
7				7				
8				8				
9				9				
10				10				



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Test Report

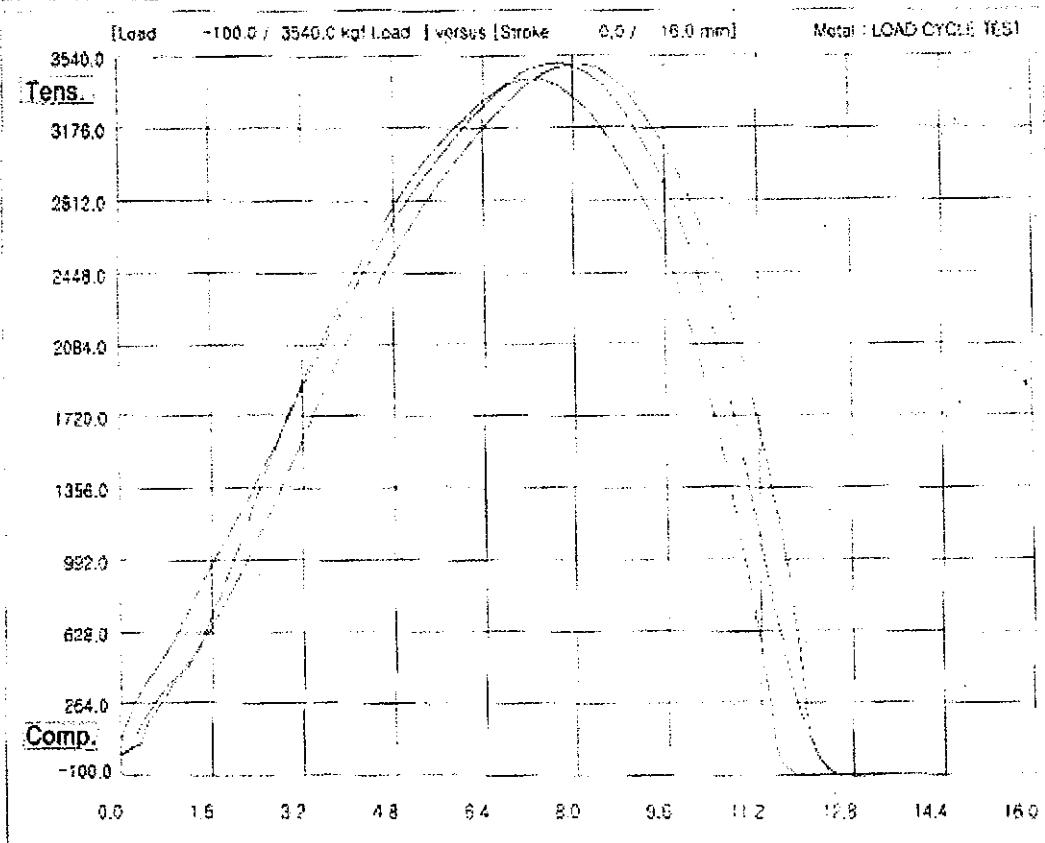
File Path:

차종(Car Model): NB-7
부품명(Part Name): UPR ARM ASSY
시험항목(Test Item): 외압 하중 시험
시료수(Q'ty): 3EA
평가기준(Criteria): MIN 3,000 kgf

납품처(Customer): KMC
의뢰자(Requester): 관현동
도입부서(Deprtment): 차량
목적(Purpose): 개발 사용
방법(Test Method):

NO. & Lot.	Data	방법(Method)		압축(Comp.)		인장(Tens.)	
		시험속도(Speed : 1)	속도(Stroke : 1)	최대(Stroke : 1)	최소(Stroke : 1)	최대(Stroke : 1)	최소(Stroke : 1)
1	0	20.0	-85.1	12.7	-3501.1	7.7	
2	0	20.0	-85.7	11.8	-3421.9	7.3	
3	0	20.0	-83.9	12.4	-3496.6	8.0	
Average		20.0	-88.6	12.3	-3473.2	7.7	
Unit		mm/min	kgf	mm	kgf	mm	

- MEMO -



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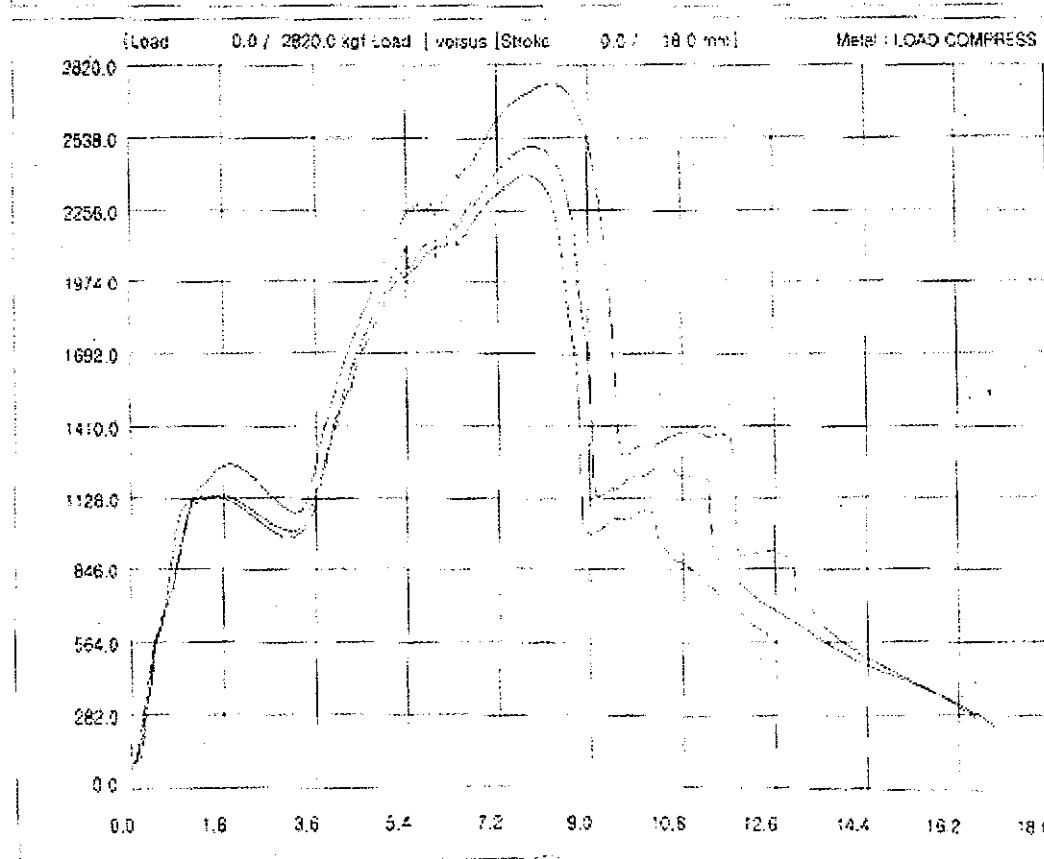
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Test Report

File Path:		고객(Customer)	KMC
차종(Car Model)	NB-7	의뢰자(Requester)	조한봉
부품명(Part Name)	UPR ARM ASS'Y	용역부서(Department)	개발
시험항목(Test Item)	임합하중 시험	목적(Purpose)	개발 서류
사요수(O'ly)	3EA	방법(Test Method)	
평가기준(Criteria)	MIN 1,500 kgf		

NO. & Lot.	Data	방법(Method)	최대경 Peak P.		
			단위	속도	최대경 (kgf)
1	0		mm/min	Second : 1	2392.4
2	0				2507.5
3	0				2747.9
Average					2551.3
Unit					kgf

- MEMO -



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Test Report

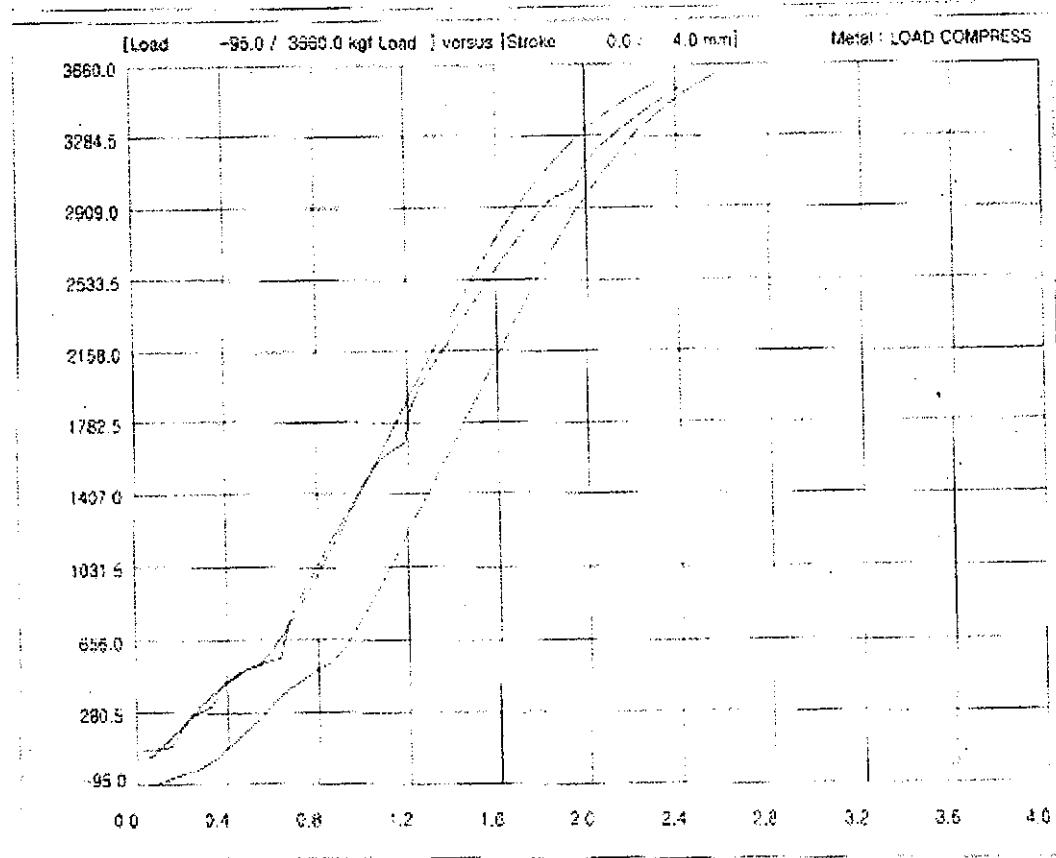
File Path:

차종(Car Model) : NB-7
 부품명(Part Name) : UPR ARM ASSY
 시험항목(Test Item) : B/STUD 경축금형 시험
 시험수(Q'ty) : 3EA
 평가기준(Criteria) : 2,300 kgf 이하로 표준 및 균일 적용 것

구매처(Customer) : KMC
 주문자(Requester) : 재한정
 의뢰부서(Department) : 개발
 목적(Purpose) : 개발시험
 방법(Test Method)

NO. & Lot.	Data	방법(Method)	최대강 (Peak P)		
			평균값	최대값	최소값
1	0	Leered 11	20.0	3944.0	2.4
2	0	20.0	3620.4	2.6	
3	0	20.0	3564.5	2.3	
Average			20.0	3576.3	2.4
Unit		mm/min		kgf	mm

- MEMO -



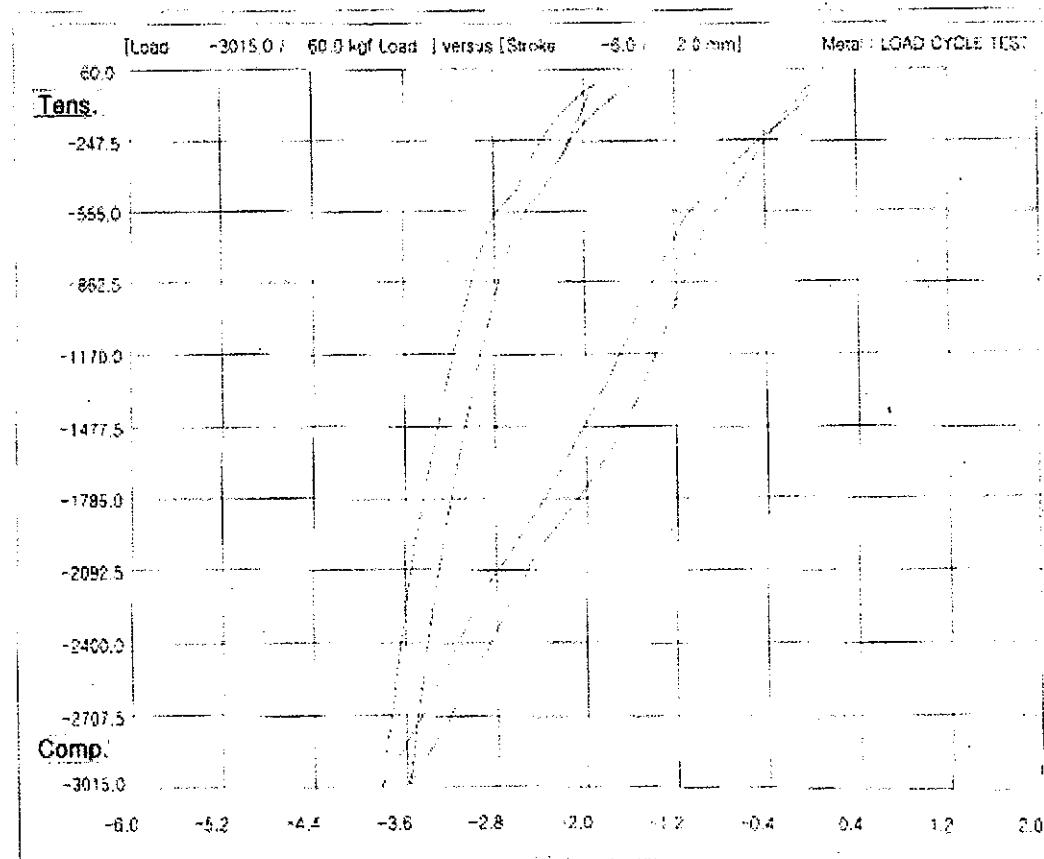
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Test Report

File Path:			Customer:	KMC
차종(Car Model)	HB-7		의뢰처(Requester)	제한동
부품명(Part Name)	UPR APM ASS'Y		의뢰부서(Department)	개발
시험항목(Test Item)	필판형 단하중 시험		목적(Purpose)	기밀시험
시험수(Qty)	2EA		시험방법(Test Method)	
평가기준(Criteria)	3,000 kgf의 하중 부하시 90/Joint 최초 단절되었을 때		인장(Tensile)	
Data	방법(Method)	압축(Comp.)		인장(Tensile)
NO. & Lot.	속도(Speed)	Load	Stroke	Load
1	10.0	-3001.5	-3.6	0.0
2	10.0	-3008.9	-3.8	0.0
Average	10.0	-3005.2	-3.7	0.0
Unit	mm/min	kgf	mm	kgf

- MEMO -



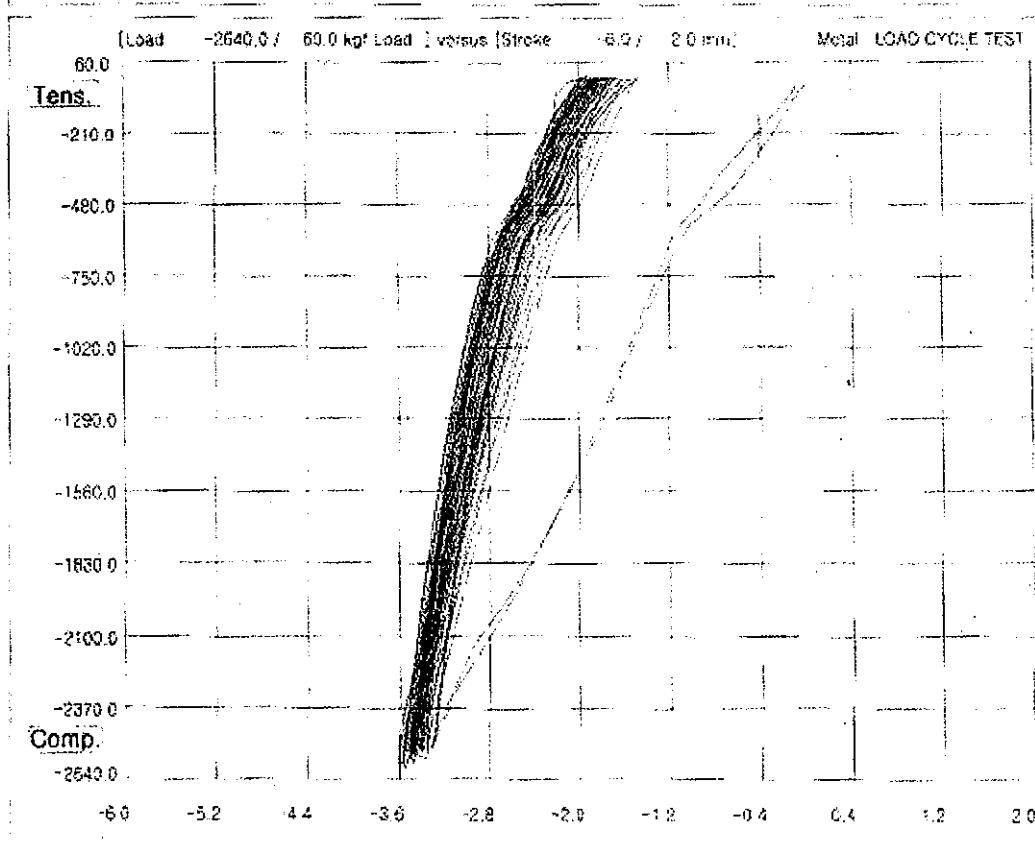
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Test Report

File Path:	NB-7	고객명(Customer):	KMC
차종(Car Model)	UPR APM ASS Y	요구자(Requester):	제한준
부품명(Part Name)	내연 충격 시험	부서(Department):	개발
시험항목(Test Item)	2EA	목적(Purpose):	개발 사용
용기기준(Criteria)	2,500 kgf의 충격 테스트 10회 무하사 최소 얻을 것임(Last Method)		
Data	방법(Method)	압축(Comp.)	온정(Tens.)
NO. & Lot.	시험속도(Speed)	최대(Comp.)	최대(Tens.)
1	0 mm/min	-2634.2	-3.6
2	0 mm/min	-2653.1	-3.5
Average	10.0 mm/min	-2643.7	-3.6
Unit	mm/min	kgf	mm
		kgf	kgf
		mm	mm

- MEMO -



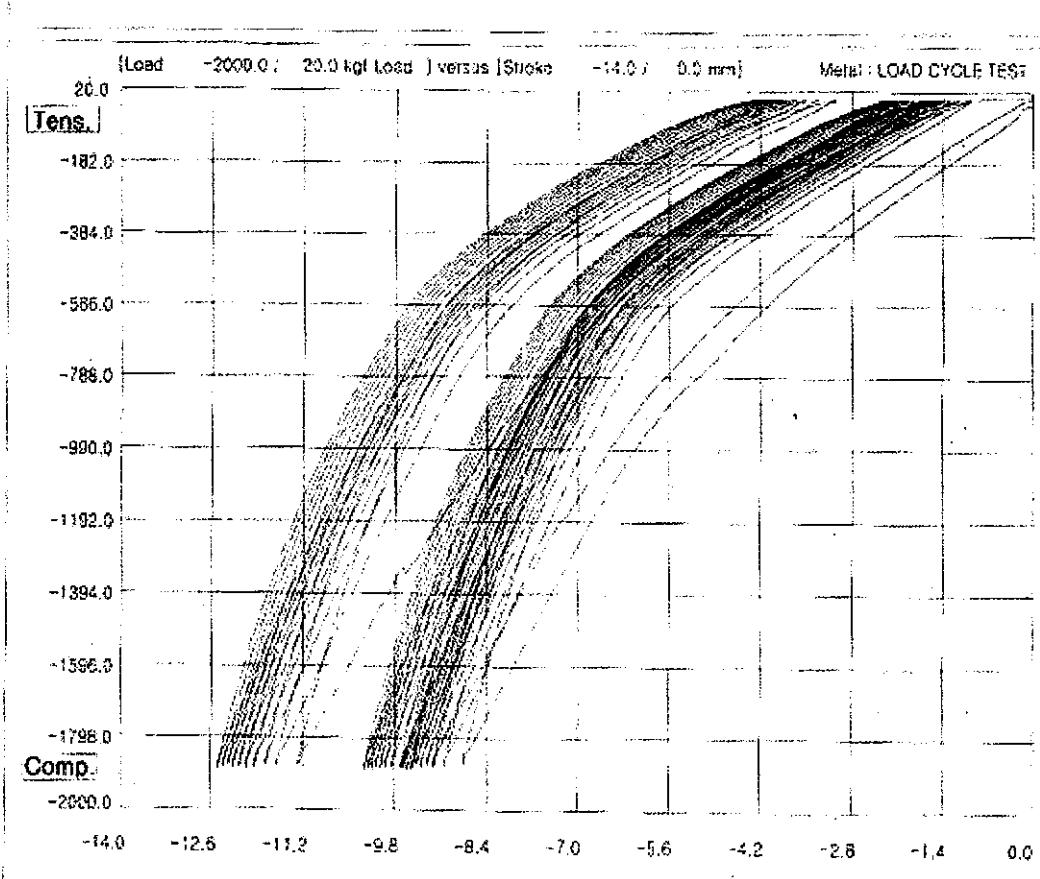
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Test Report

File Path:		Customer:				
차종(Car Model)	NB-7	납품처(Customer)	KMC			
부품명(Part Name)	RUCA ASSY	요청자(Requester)	홍봉길			
시험항목(Test Item)	ASSY 침보 사용	의뢰부서(Department)				
사용 수(Q'ty)	3 EA	목적(Purpose)	개량 시험			
평가 기준(Criteria)	F=1,862 kgf ± 10% 허용	방법(Test Method)				
Data	방법(Method)	측정(Comp.)	인장(Tens.)			
NO. & Lot.	(Speed 1)	(Load 1)	(Speed 2)	(Load 2)	(Load 3)	(Speed 4)
1	0	20.0	-1886.7	-12.5	4.7	0.0
2	0	20.0	-1888.5	-9.6	0.0	0.0
3	0	20.0	-1892.2	-10.3	0.0	0.0
Average		20.0	-1889.1	-10.9	1.6	0.0
Unit		mm/min	kg	mm	kgf	mm

- MEMO -



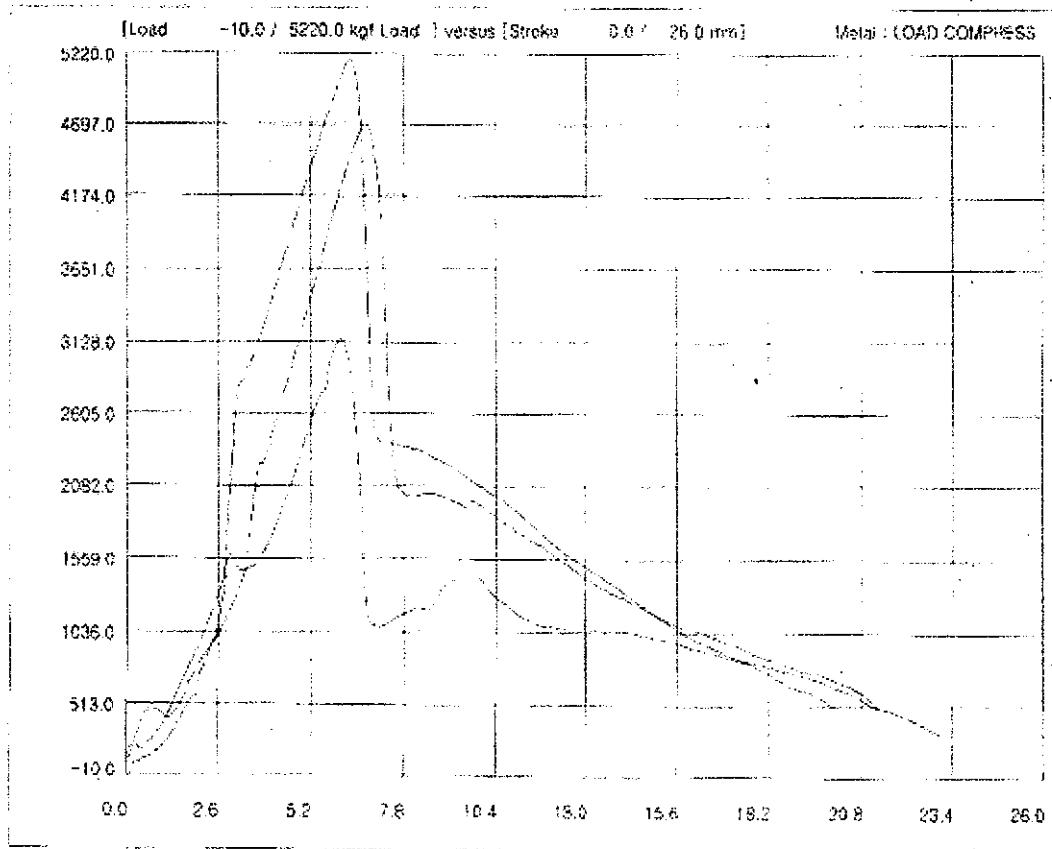
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Test Report

File Path:		Customer:	
차종(Car Model)	N8-7	담당자(Customer)	KWC
부품명(Part Name)	UPA ARM ASS Y	제작처(Manufacturer)	제한동
시험항목(Test Item)	BUSH 봉감하중 테스트	의뢰부서(Department)	개발
시료수(Q'ty)	3EA	목적(Purpose)	제당시험
평가기준(Criteria)	MIN 1,000 kgf	방법(Test Method)	
Data	방법(Method)	최대값 (Peak P)	
NO. & Lot.	시험속도(Speed)	최대값(Peak P)	평균값(Avg P)
1 0	30.0	3155.3	6.0
2 0	30.0	5180.8	6.3
3 0	30.0	4701.7	6.7
Average	30.0	4945.9	6.3
Unit	mm/min	kgf	mm

- MEMO -



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TEST REPORT

Tester **Review** **Approval**

Review

Approval



CTR Laboratory

TEST REPORT

Tester Review Approval

File Path										
시험 항목 (TEST ITEM)	축 및 원심력 허용 범위 (AXIAL AND RADIAL END TRAVEL)									
고객 (CUSTOMER)	KMC	차종 (CAR MODEL)	NB-7	품명 (PART NAME)	RUCA ASSY					
BOM No.		LOT No.		의뢰자 (REQUESTER)	총무팀					
시험 목적 (TEST PURPOSE)	<input type="checkbox"/> 개발시험 <input type="checkbox"/> 초기검사 <input type="checkbox"/> 공정검사 <input checked="" type="checkbox"/> 고품번식 <input type="checkbox"/> 연구분석 DEVELOPMENT MONITORING PROCESS POST-TEST RESEARCH					시험일 (DATE)	4/18			
	<input type="checkbox"/> SOP <input type="checkbox"/> PPAP <input type="checkbox"/> PROTO (PV) <input type="checkbox"/> PROTO (DV) <input type="checkbox"/> INITIAL SAMPLE					시료 수 (COUNT)	3 pcs			
조립 (제작) 조건 (MANUFACTURING CONDITION)										
시험 방법 (METHOD)	축 하중 (AXIAL LOAD)	30 kgf	H ₂	축과 기준 (CRITERIA)	축 유행 (AXIAL END TRAVEL)	0.1 mm				
	주변 하중 (RADIAL LOAD)	200 kgf	H ₂	방 유행 (RADIAL END TRAVEL)	0.15 mm					
시험 결과 (Test Result)										
축 유행 (AXIAL END TRAVEL) [mm]					방 유행 (RADIAL END TRAVEL) [mm]					
No	Compressive Disp.	Tensile Disp.	Total Displ.	Displacement	No	Compressive Disp.	Tensile Disp.	Total Displ.	Displacement	
1	0.001	-0.004	0.005	0.005	1	0.060	-0.076	0.136	0.074	
2	0.002	-0.007	0.009	0.007	2	0.091	-0.088	0.180	0.091	
3	0.003	-0.004	0.007	0.006	3	0.069	-0.071	0.140	0.078	
4					4					
5					5					
6					6					
7					7					
8					8					
9					9					
10					10					



CTR Laboratory

Kia Motors America
Parts Sales for Part Number 0K011 34200A - Arm Assy, Upper
June 1, 2001 thru February 15, 2008

Part Sales for the 1995-2002 Kia
Sportage; see letter

Sum of Ship Qty		Part #	
Ship Year	Ship Month	0K011 34200A	Grand Total
2001	06	44	44
	07	46	46
	08	56	56
	09	71	71
	10	83	83
	11	57	57
	12	55	55
2001 Total		412	412
2002	01	61	61
	02	60	60
	03	49	49
	04	55	55
	05	59	59
	06	57	57
	07	78	78
	08	58	58
	09	55	55
	10	96	96
	11	60	60
	12	63	63
2002 Total		751	751
2003	01	67	67
	02	62	62
	03	70	70
	04	53	53
	05	64	64
	06	65	65
	07	64	64
	08	49	49
	09	57	57
	10	67	67
	11	35	35
	12	69	69
2003 Total		722	722
2004	01	68	68
	02	57	57
	03	71	71
	04	60	60
	05	56	56
	06	70	70
	07	59	59
	08	48	48
	09	64	64
	10	50	50
	11	63	63
	12	45	45
2004 Total		711	711

2005	01	40	40
	02	49	49
	03	57	57
	04	49	49
	05	56	56
	06	35	35
	07	43	43
	08	35	35
	09	40	40
	10	41	41
	11	55	55
	12	44	44
2005 Total		544	544
2006	01	41	41
	02	45	45
	03	62	62
	04	38	38
	05	27	27
	06	32	32
	07	54	54
	08	39	39
	09	37	37
	10	35	35
	11	25	25
	12	26	26
2006 Total		461	461
2007	01	23	23
	02	41	41
	03	27	27
	04	19	19
	05	34	34
	06	35	35
	07	43	43
	08	24	24
	09	35	35
	10	24	24
	11	20	20
	12	20	20
2007 Total		345	345
2008	01	21	21
	02	15	15
2008 Total		36	36
Grand Total		3982	3982