



GENERAL MOTORS NORTH AMERICA
Structure & Safety Integration

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 NVS-210

June 17, 2004

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Ms. Cheryl Tuosto
 Vehicle Control Division
 Office of Defects Investigations
 NHTSA Safety Insurance
 400 Seventh Street, S.W.
 Washington, D.C. 20590

GM-655

OFFICE OF DEFECTS
 INVESTIGATIONS

NVS-213cat
 PE04-031

Dear Ms. Tuosto:

On Tuesday, June 15, 2004, General Motors conducted a videoconference presentation with you and several other people from NHTSA-ODI, regarding the operation and functionality of the Electric Power Steering (EPS) Assist Systems used in some General Motors vehicles. The presentation also included a review of manual and hydraulic power steering assist systems.

The following individuals attended the videoconference:

Jeff Quandt - Division Chief, NHTSA-ODI
 Cheryl Tuosto - Safety Defects Engineer, NHTSA-ODI
 Scott Yon - Safety Defects Engineer, NHTSA-ODI
 Co-Op Student (name unknown) - NHTSA-ODI
 Dave Juarez - Design Engineer - Electric Steering, General Motors
 Keith Schultz - Senior Manager - Product Investigations, General Motors
 Gary Dowd - Field Performance Engineer - Product Investigations, General Motors

Upon completion of the presentation, discussions between NHTSA-ODI and General Motors personnel regarding General Motors response to PE04-031 prompted the following requests from NHTSA-ODI:

- 1) GM to provide copy of the presentation reviewed in the videoconference (Attachment 1)
- 2) GM to provide a final version of the "draft" service bulletin included in response to PE04-031 (Attachment 2).
- 3) GM will review in late July 2004 information regarding the incident and warranty rates of the subject condition.
- 4) GM will provide information regarding the life cycle testing of the torque and position sensor used in the subject vehicle EPS. As reviewed in the presentation, Delphi has begun life cycle testing of six torque and position sensors and has had no failures to date. NOTE: The life cycle test of each torque and position sensor consists of one million cycles at 195 degrees rotation per cycle.

Sincerely,

Gary M. Dowd
 Field Performance Engineer
 GM Product Investigations
 (586) 986-7974

Attachments

Product Investigations

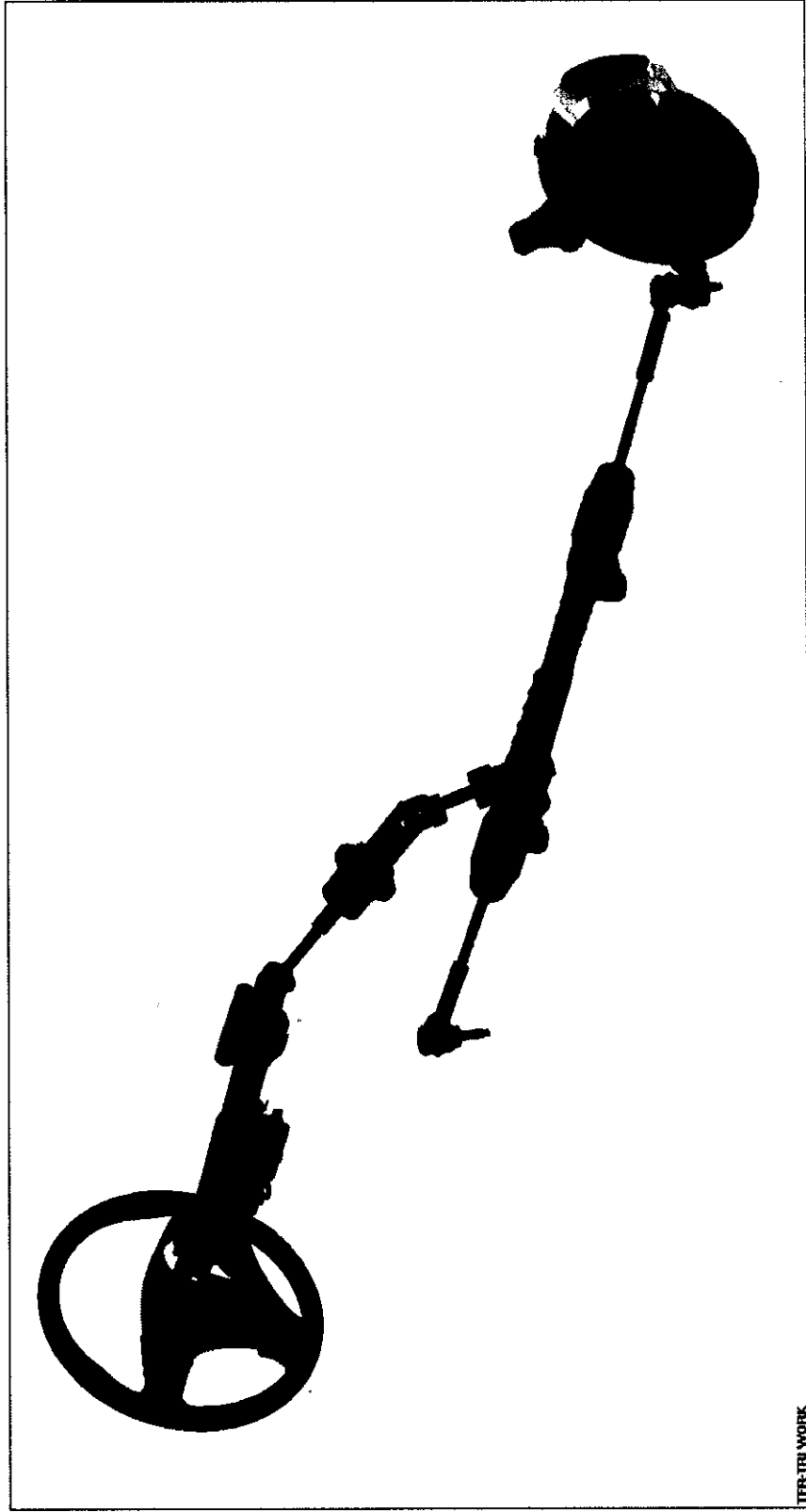
Mail Code: 480-106-304 • 30500 Mound Road • Warren, MI 48090-9055
 Phone: (586) 986-8029 • Fax: (586) 947-2318
 Videoconference Presentation 6-15-04



Steering System Principles of Operation

- Manual Steering
- Hydraulic Power Steering
- Electric Power Steering

Manual Steering System

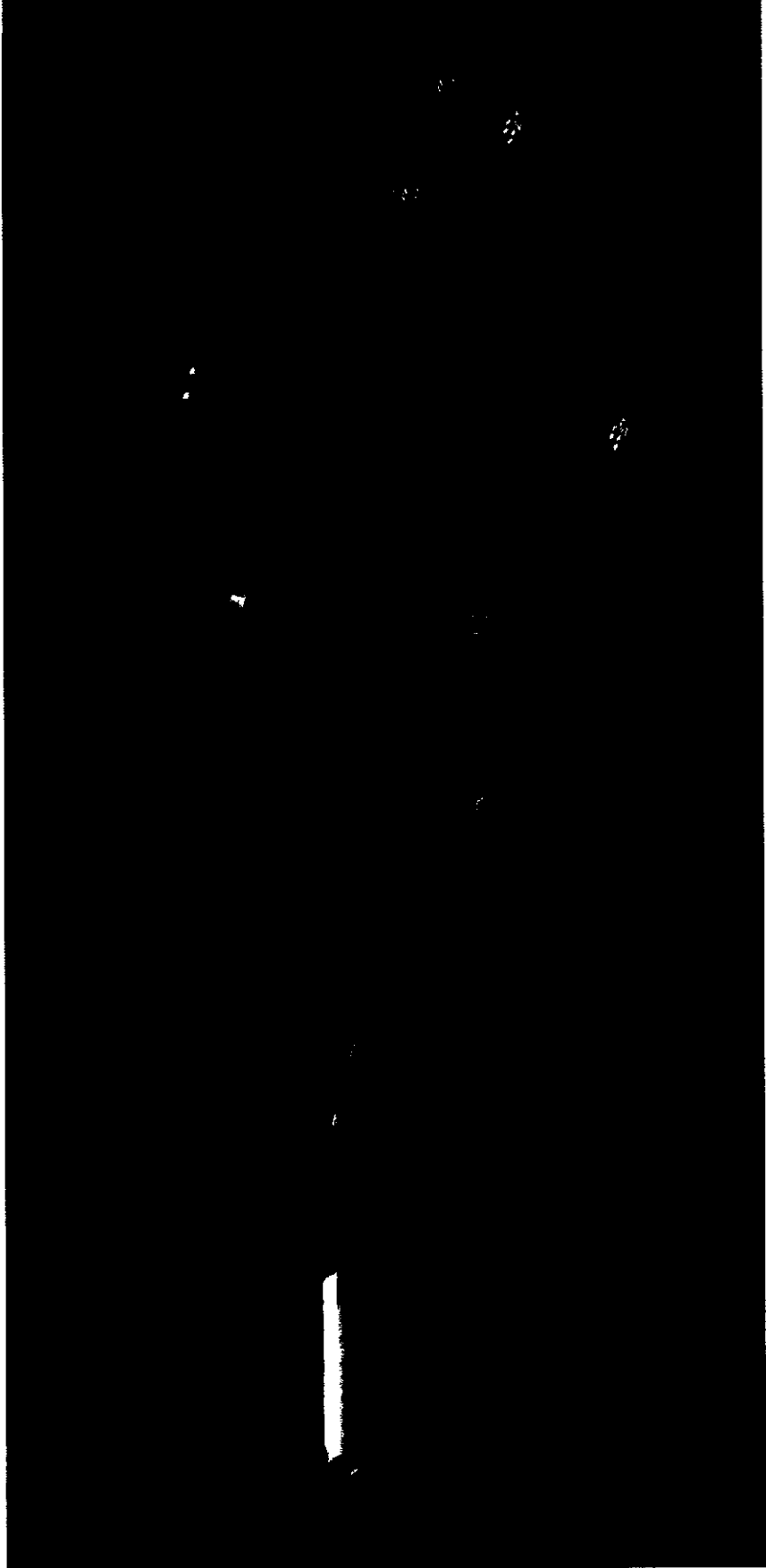


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Manual Steering System

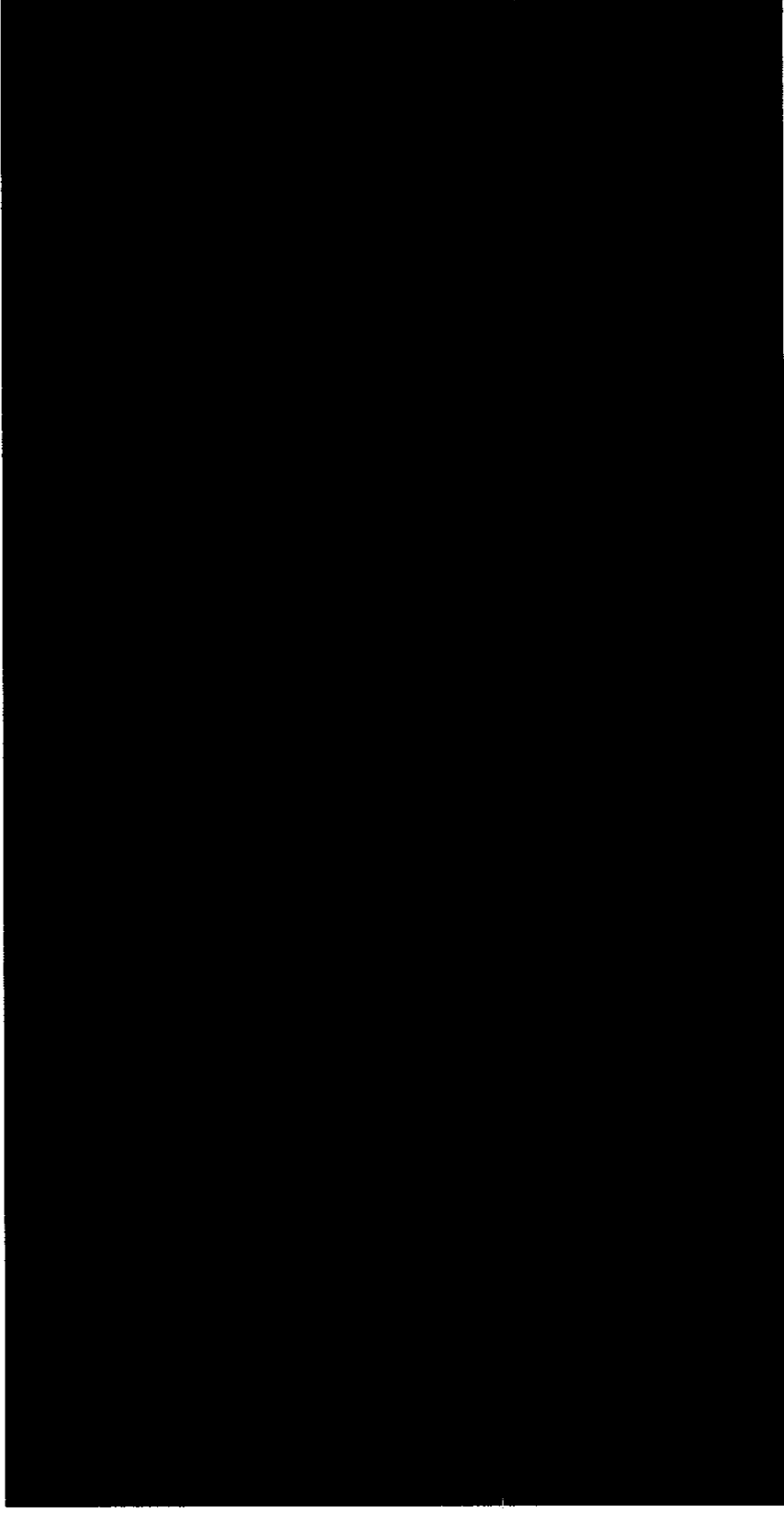
- The driver provides a torque to the column shaft through the steering wheel
- The column shaft transfers the torque to the intermediate steering shaft
- The intermediate steering shaft transfers the torque to the steering gear
- The steering gear transforms the torque to a linear force
- The linear force is transformed to a torque at the steering knuckle, which in turn, rotates the front wheels

Hydraulic Power Steering



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Hydraulic Steering Gear



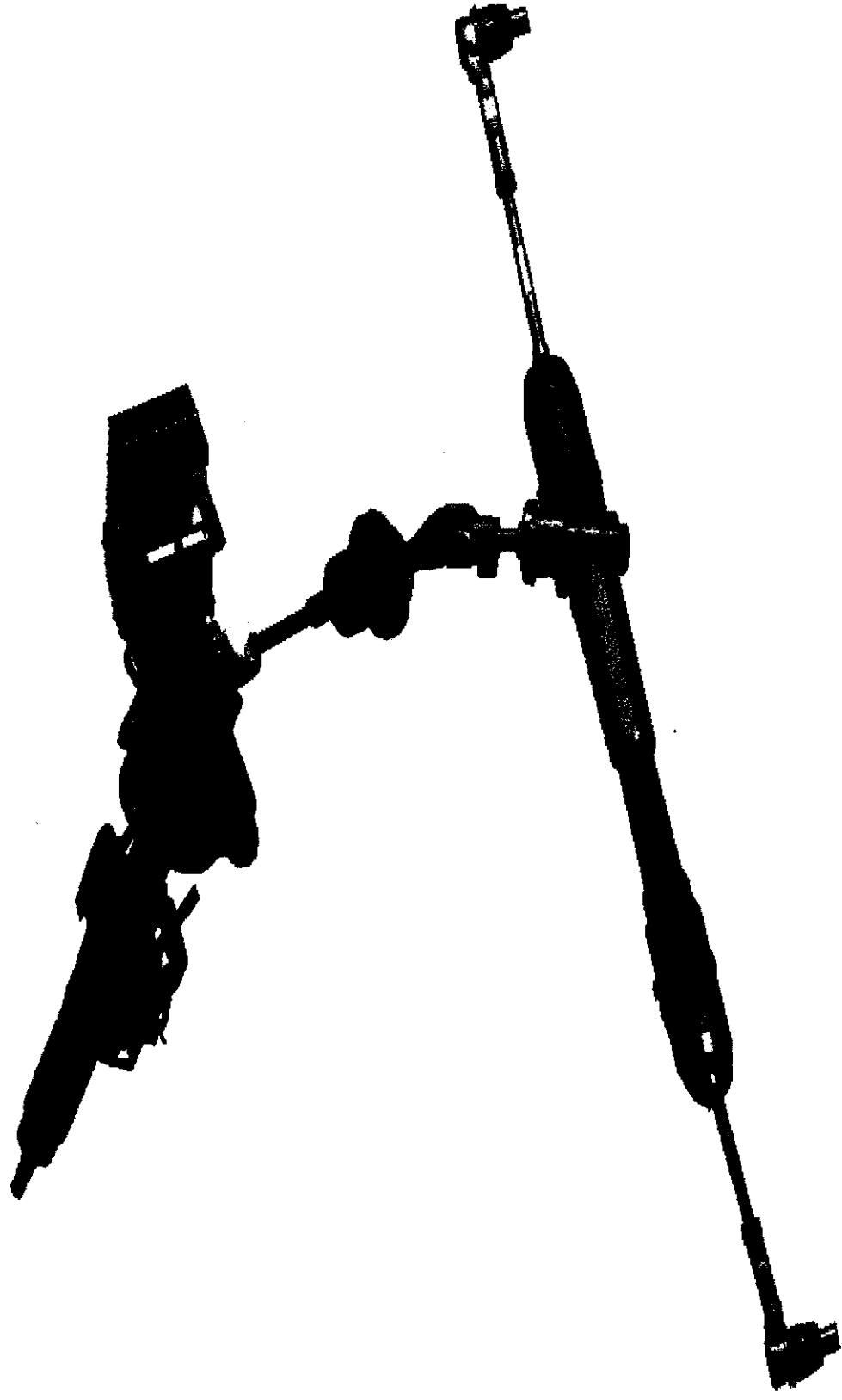
Hydraulic Power Steering

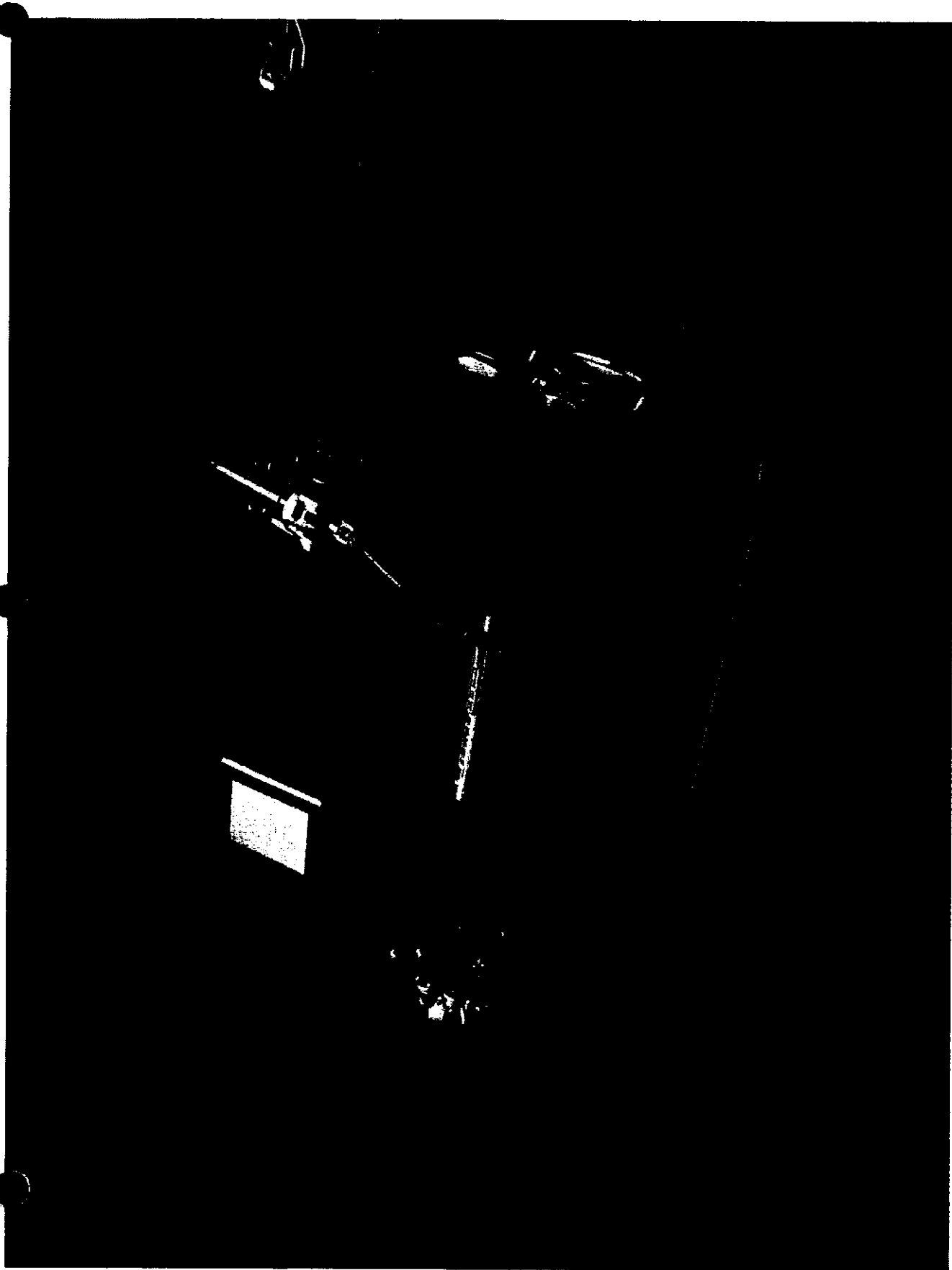
- A pump provides hydraulic pressure for the steering gear
- The steering gear contains a hydraulic cylinder and piston to provide the steering assist
- A rotary valve controls which side (left / right) of the piston the hydraulic pressure is applied to
- Assist is provided in the form of a force in a linear motion

Hydraulic Power Steering

- The rotary valve also controls the amount of assist the steering gear provides
- The assist curve is based on the physical characteristics machined into the rotary valve
- This system uses both mechanical and hydraulic components to provide the assist

Electric Power Steering

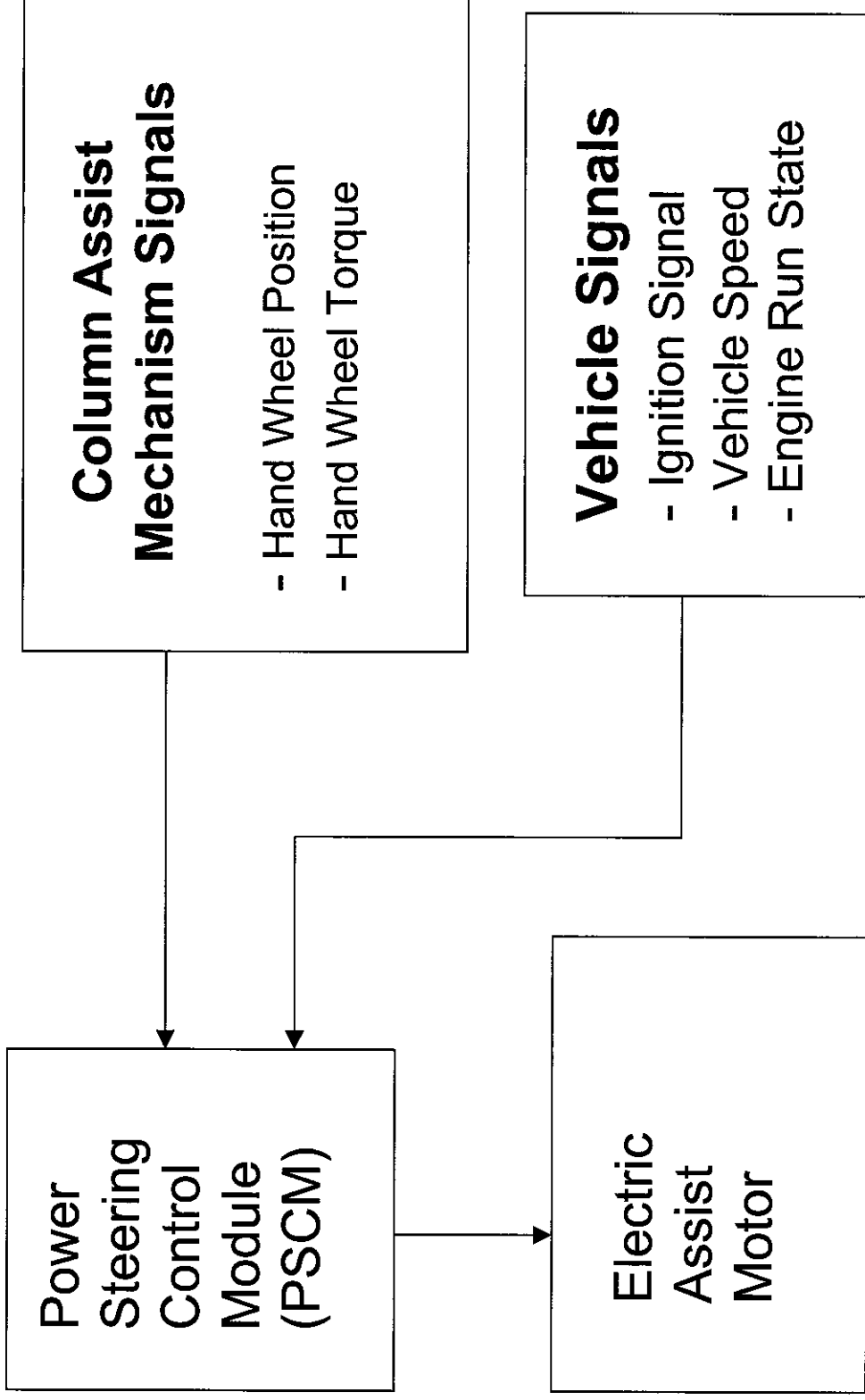




Electric Power Steering

- An electric motor provides the assist for the steering system
- The motor is attached to a worm gear which meshes with a ring gear on the column output shaft
- The motor torque is multiplied by this gear set to provide the steering assist
- Assist is provided in the form of a torque from the steering column assist mechanism

Electric Power Steering



Electric Power Steering

- The PSCM uses the input signals to determine the amount of assist provided
- The assist level is based on vehicle speed, hand wheel position and hand wheel torque
- The assist data is stored in the PSCM
- This system uses both mechanical and electrical components to provide the assist

Document ID# 1521111

Noisy Steering Column, Lack of Power Steering Assist, DTCs C0460 and C0545, Steering Wheel Moves Slightly By Itself (Replace Steering Column) #04-02-35-009 - (05/24/2004)**Noisy Steering Column, Lack of Power Steering Assist, DTCs C0460 and C0545, Steering Wheel Moves Slightly By Itself (Replace Steering Column)**

2004 Chevrolet Malibu

Condition

Some customers may comment on any of the following concerns:

- A rattle or clunk noise from the left lower instrument panel or foot well area.
- With the engine running and the vehicle not moving, the steering wheel may move a few degrees off center, left and right, by itself, without driver input.
- With the vehicle in motion, the driver may comment about a steering wheel vibration that feels like a wheel out of balance. This condition does not impair the ability of the driver to control the vehicle.
- An intermittent lack of power steering assist.

Technicians may find the following diagnostic trouble codes:

- Diagnostic Trouble Code C0460 Symptom 00 (Steering Position Sensor)
- Diagnostic Trouble Code C0545 Symptom 00 (Steering Wheel Torque Input Sensor)

Cause

These conditions may be caused by excessive clearance between the assist gears or by a failure of the torque sensor in the steering column.

Noise Diagnosis

Perform the following check as an aid in diagnosing a steering column noise. With the engine running and the vehicle not moving, turn the steering wheel rapidly back and forth an inch or two off center and listen for a click or rattle noise inside

the steering column. If these noises are present, it may indicate excessive clearance between the gears inside the steering column.

Correction

Technicians are to install a new steering column kit, P/N 10373948, to correct the conditions listed above. Refer to the Steering Column Replacement procedure in the Steering section of SI (Document ID #1244472).

Parts Information

Part Number	Description	Qty
10373948	Column Kit, Steering	1

Parts are currently available from GMSPO.

Warranty Information

For vehicles repaired under warranty, use:

Labor Operation	Description	Labor Time
E7680	Column Assembly, Steering - Replace	Use published labor operation time

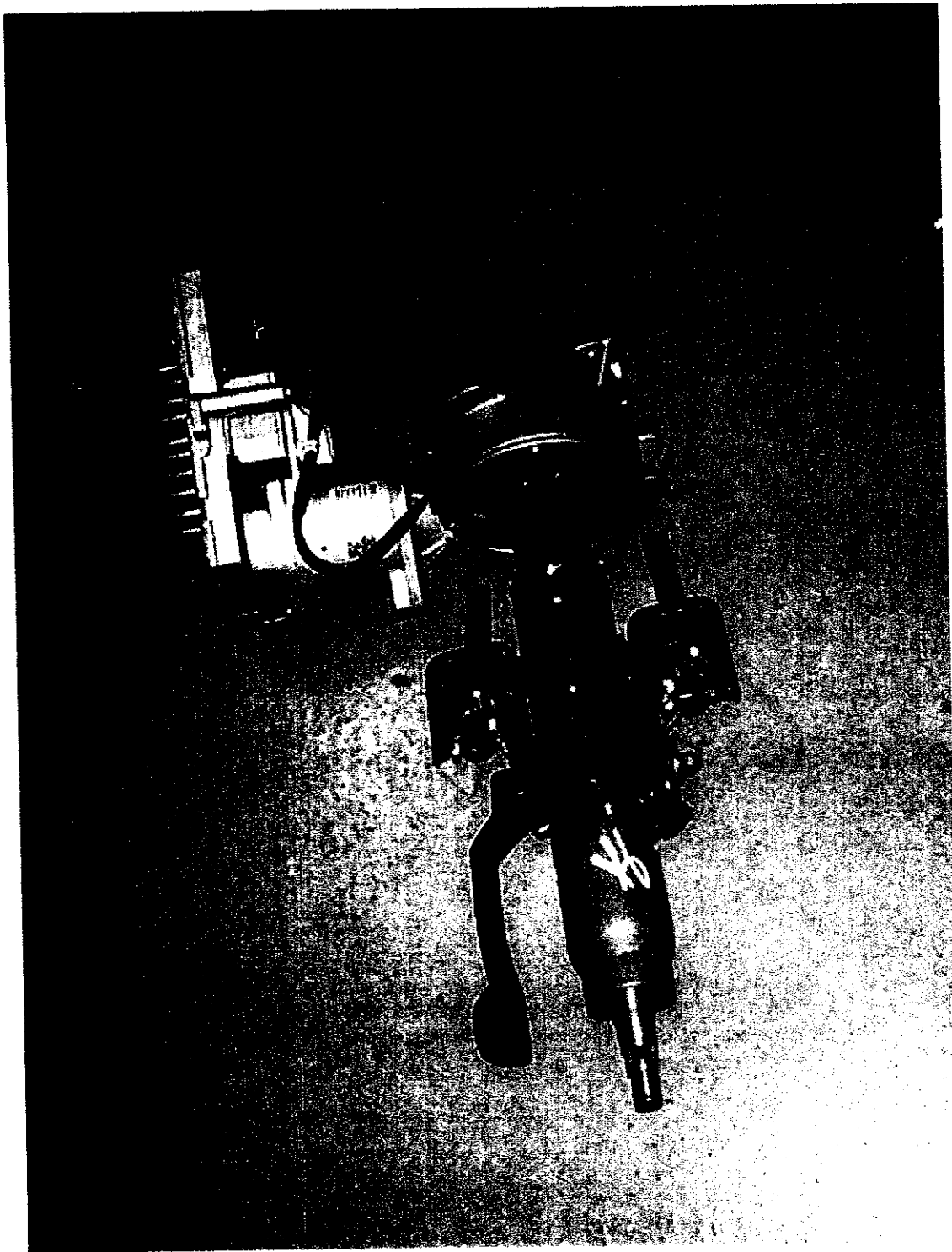
GM bulletins are intended for use by professional technicians, NOT a "do-it-yourselfer". They are written to inform these technicians of conditions that may occur on some vehicles, or to provide information that could assist in the proper service of a vehicle. Properly trained technicians have the equipment, tools, safety instructions, and know-how to do a job properly and safely. If a condition is described, DO NOT assume that the bulletin applies to your vehicle, or that your vehicle will have that condition. See your GM dealer for information on whether your vehicle may benefit from the information.



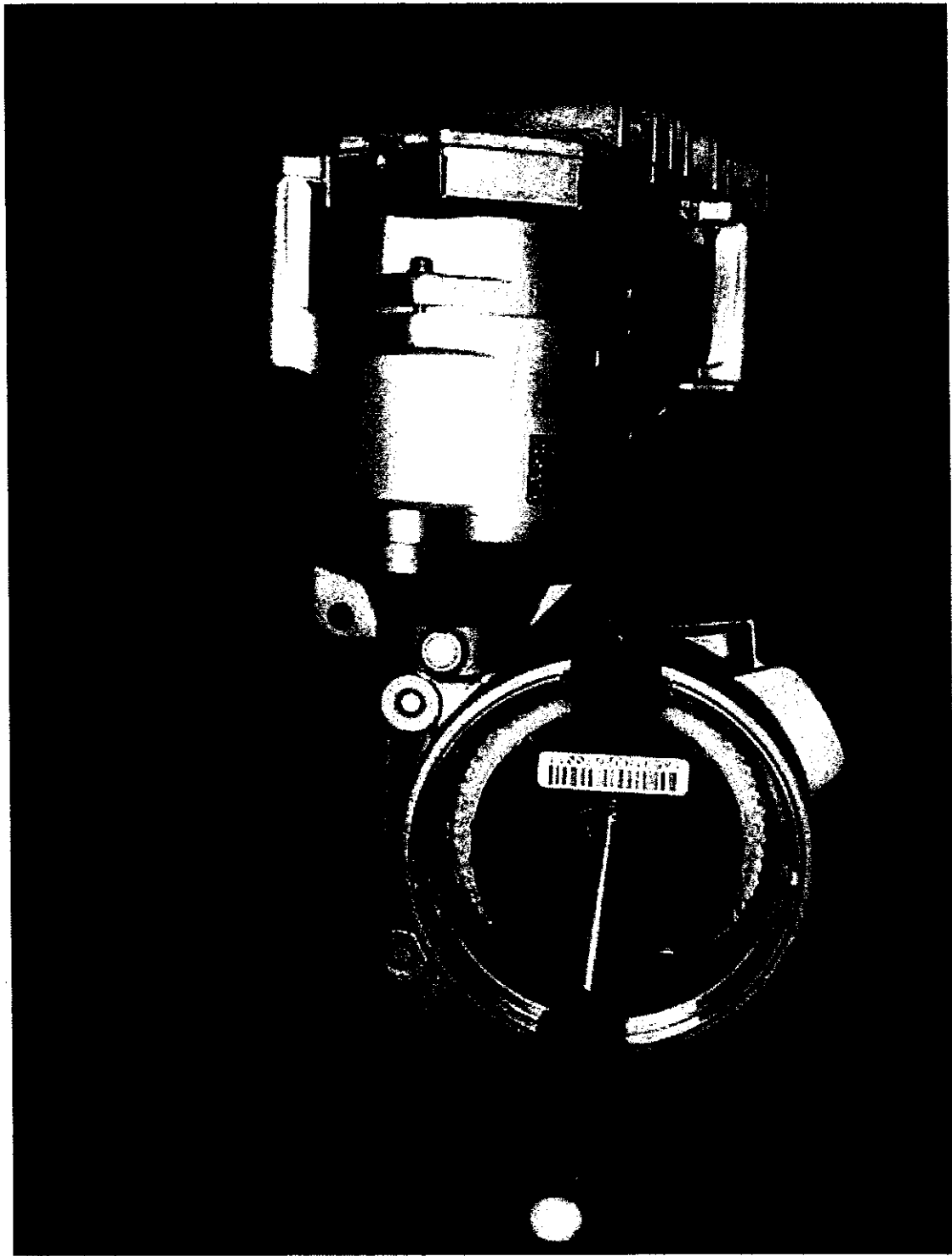
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Document ID# 1521111



Column Assist System (CAS) -- Epsilon



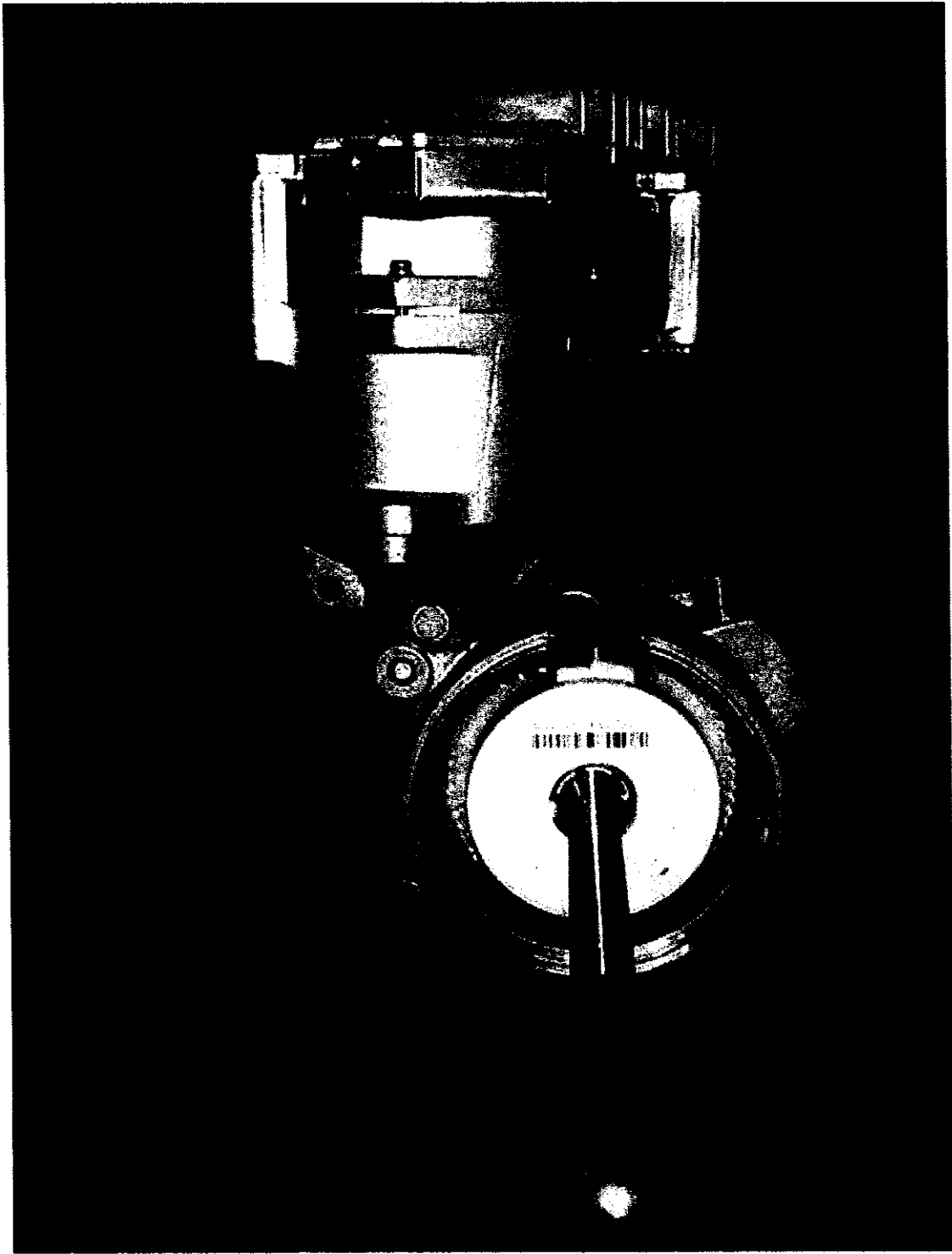
Assist Mechanism Assembly – Epsilon (with Furukawa sensor)



Torque and Position Sensor – Epsilon (Furukawa)



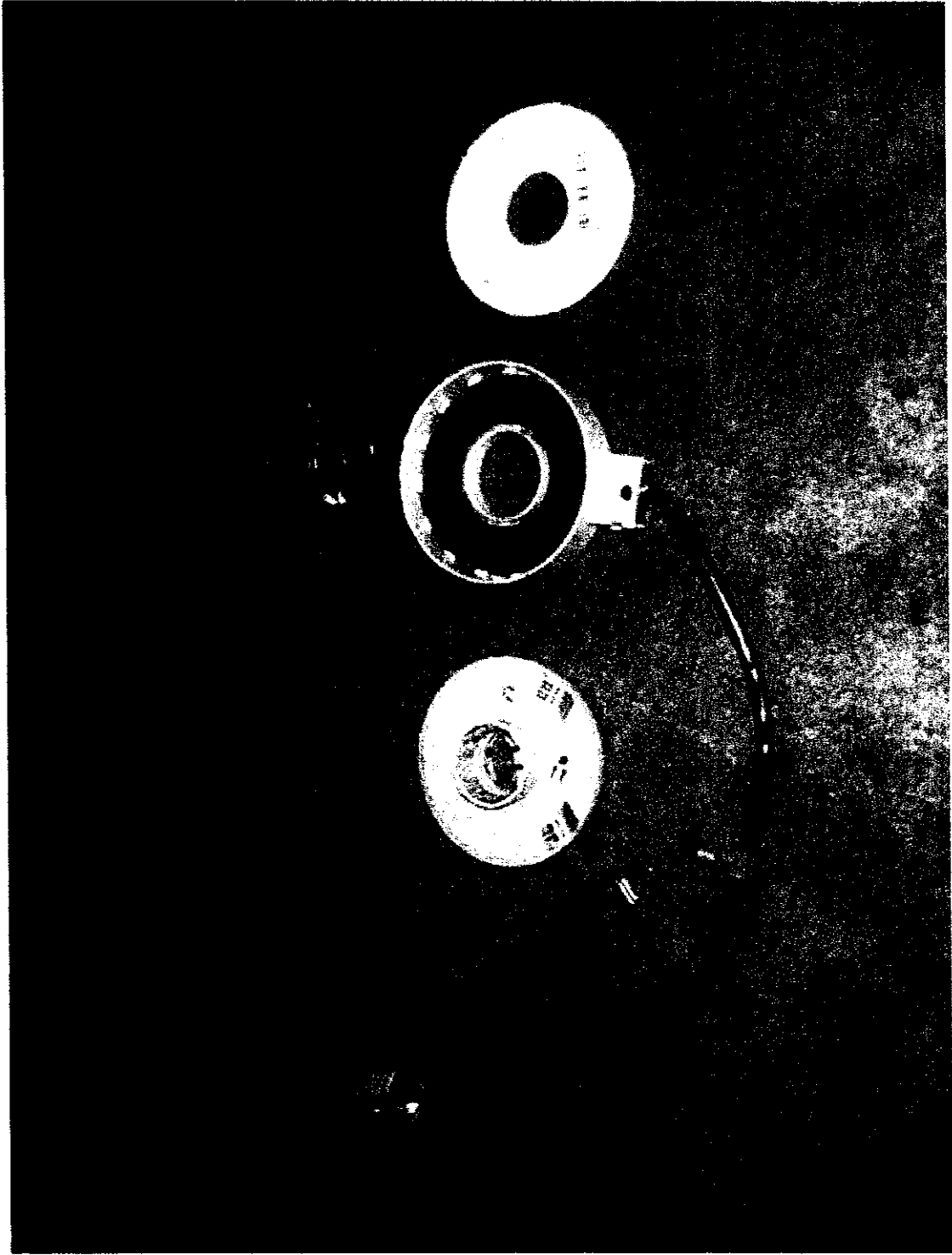
Torque and Position Sensor – Epsilon (Furukawa)



Assist Mechanism Assembly – Epsilon (with BI sensor)



Torque and Position Sensor – Epsilon (BI)



Torque and Position Sensor – Epsilon (BI)

Part #	Part Description	Part of Asm	Replaces	Replaced By	Model Year	Div.	Usage	Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Source to Dealer	Totals	Source Code
10373948	COLUMN KIT,STRG		22687709		04-05	1	ZA																0579
22687709	COLUMN KIT,STRG		26105479	10373948	04-05	1	ZA	2003															0579
								2004	509	605	1400	1362	0	0	0	0	1	15	34	189			274
																							3993
26105479	COLUMN KIT,STRG		22687709																				N/A
Removed Apr-04																							
15138693	MOTOR,P/S ASST (W/CONT MDL)		22687710		04-05	1	ZA																0579
22687710	MOTOR,P/S ASST (W/CONT MDL)		22732975	15138693	04-05	1	ZA	2003															0579
								2004	25	25	119	106	0	0	0	0	8	7	2	27			57
																							331
22732975	MOTOR ASM-P/S ASST		22687710																				N/A