Keihin Seimitsu Kogyo Co., Ltd.

KSK Concept and Products

"Creation based upon intelligence and five senses"

Yukinao Takeya, April 2012

The KSK Concept of Creation: “Creation based on intelligence and the five senses”

The intelligence to conceive improvements and modifications, and the five human senses that follows up on the mistakes that tend to occur with computer control.
The concept behind this “Creation based on intelligence and the five senses” represent our fundamental guideline, and we put it to maximum use through all processes, from design through to manufacture.
“Creation based on intelligence and the five senses” helps us instill an analog sense into state-of-the-art digital machines, and there is no end to the improvements that can be made.
We will **continue to work on improvement over improvement** to constantly enhance our powers of creation so that we can be assured of the complete trust of all our clients.

We have been involved in Kaizen (improvement) exchanges with overseas nations since the 1990s, and so far **more than 800 people have visited us from overseas** to exchange ideas on the KSK way of Kaizen and creation.

KSK Creation

KSK is a manufacturer of “aluminum diecast/fully-assembled products” and “transmission control systems”.

Aluminum diecast/ fully-assembled products	**Transmission control system manufacturer**
Consistent throughout all stages of creation	**Consistent throughout all stages of product development**
Consistent throughout all manufacturing processes, from diecasting through to processing, assembly and inspections. This enables us to provide products that match up with our clients' optimal QDC requirements.	Providing mission control for a wide range of vehicles, from light vehicles through to large-sized trucks. This enables us to provide modular products that have been developed in accordance with our client's optimal requirements.

Consistent Throughout All Stages of Creation

1 **Minimizing stocks**

2 **Flexibly supporting volume variations**

3 **Quality assurance on 100% of processes**

Achieving the above to establish production methods that are consistent throughout all stages of creation to provide high-quality products inexpensively to our clients.

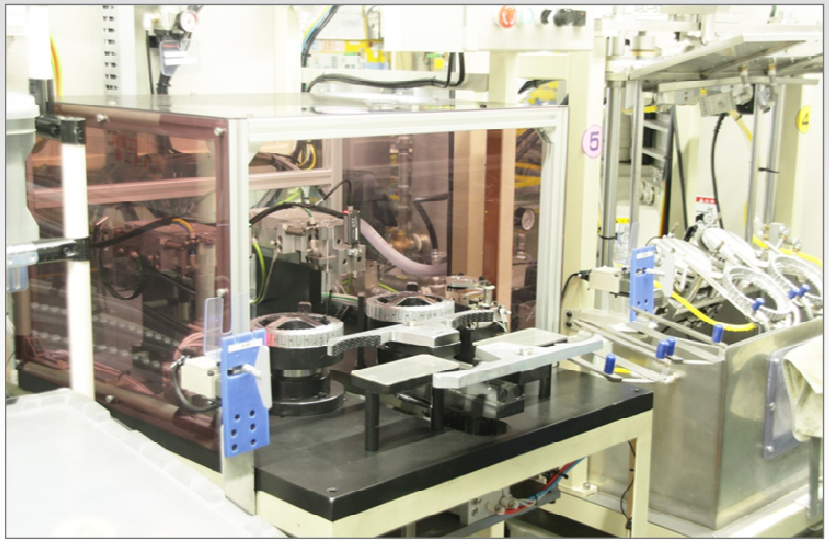
One-piece flow production
is the **basis of KSK creation**.

KSK Processing Technology

Approximately **70% of KSK's machinery and 100% of our tools are designed and manufactured in-house**, and we have established unique, imaginative and compact production lines. This not only makes daily maintenance an easy task, it also enables **continual improvement** by allowing us to upgrade the machinery and tools as and when we wish, which is a **KSK administrative policy**.

Despite the Great Eastern Japan Earthquake and other disasters that struck Japan, we were able to achieve the recovery of our production capacity within a few days.

Examples of our in-house production machinery and tools



KSK Diecasting Technology

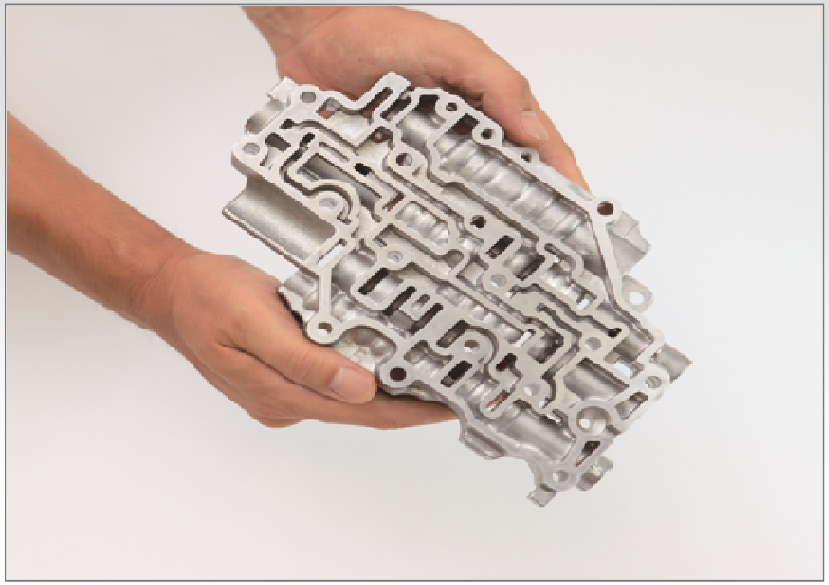
We cast products on our diecasting machines, which range between **135 and 800 tons**, and deliver the end products to our clients after processing has been completed. Our main keywords are low-cost, **compact and lightweight**.

High-strength, air-tight, high-quality

We use our diecasting technology to promote conversions away from steel and gravity-cast products.

In addition, we received an order for the valve bodies that represent ultra high-quality parts conventionally manufactured by automobile companies, produced them on our integrated one-piece flow production line, and are currently in the process of delivering them to our client.

Valve body

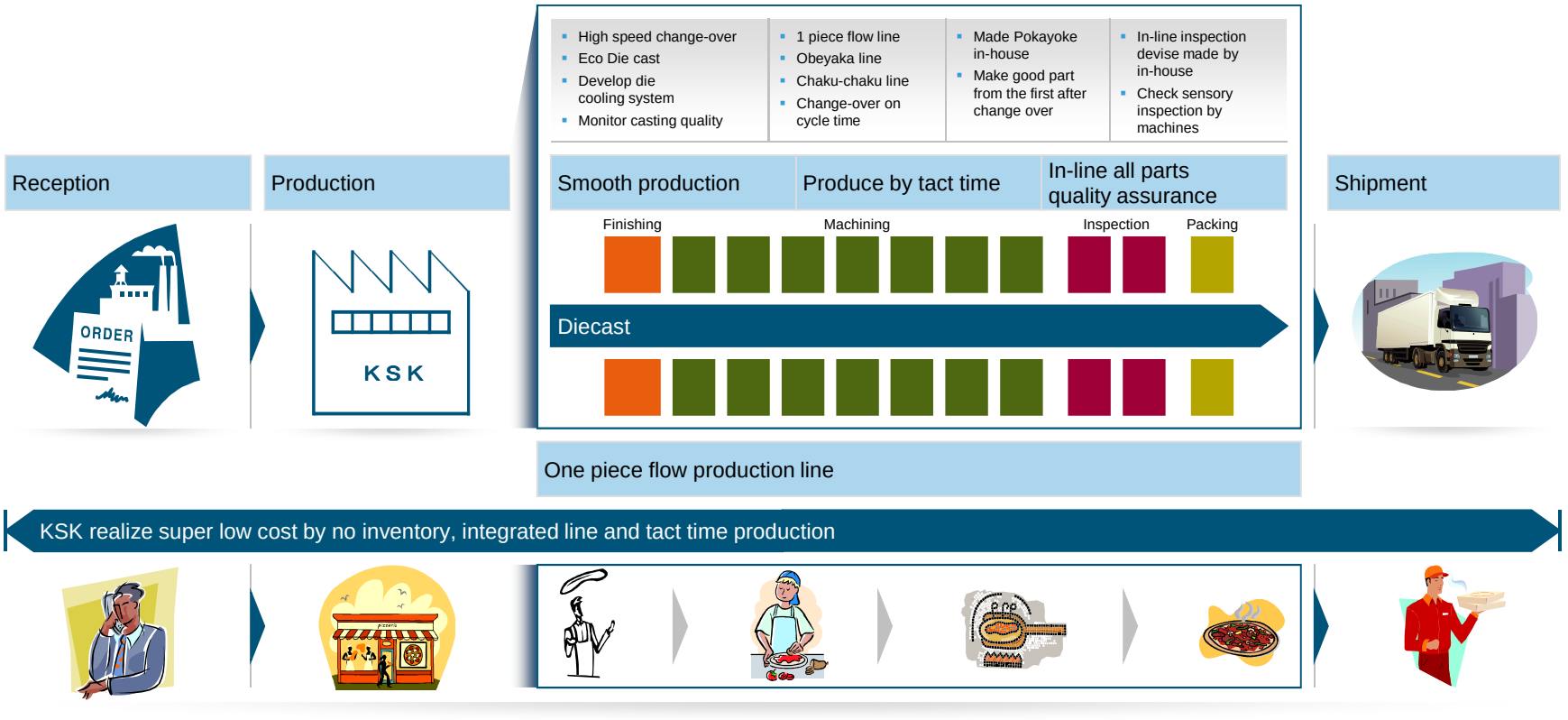


One-Piece Flow Production Line (Concept)

Products flow swiftly from the die-casting process, which represents the upstream source, through to processing and then inspections …

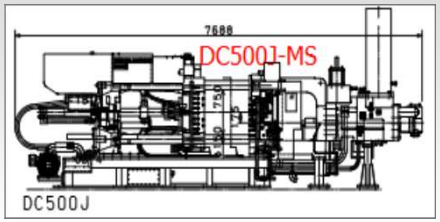
Seek and pursue are the keywords to the ideal creation. Our just-in-time production system takes this to the extreme in order to produce and deliver to our clients the “needed products”, “when needed” in the “needed quantities”. The system that enables this is our one-piece flow production lines.

To explain it from a different angle, this line represents the **“delivery pizza store for our creations”**.



One-Piece Flow Production Line (Example)

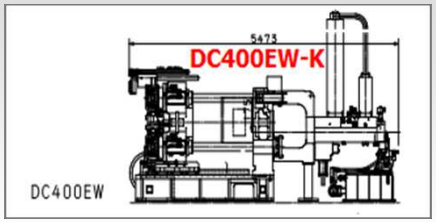
500ton Machine



Space Saved **33%**

Energy Saved **42%**

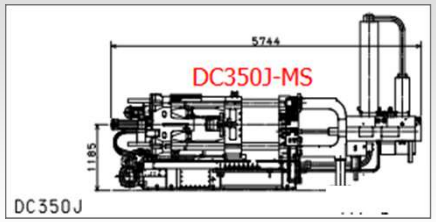
400ton Machine



Space Saved **9%**

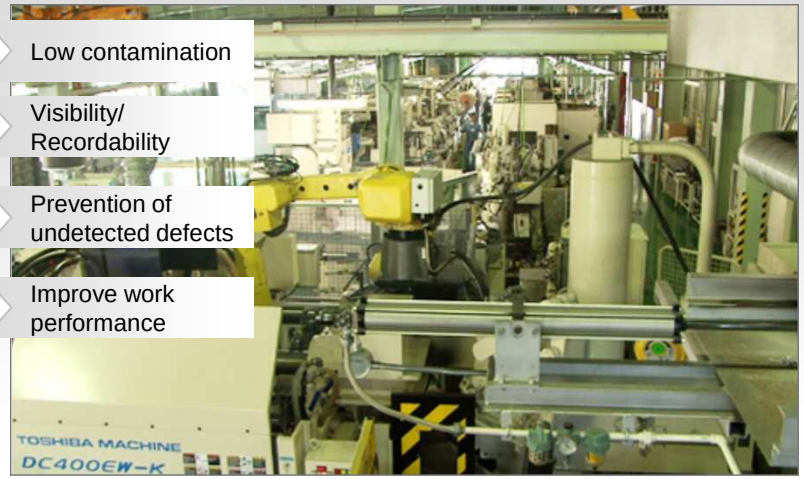
Energy Saved **12%**

350ton machine



Newly developed 400ton diecasting machine **integrated into the line** as first station

Casting	1. Uses an oil-based mold release agent with a new cooling system	Low contamination
	2. Constant monitoring of diecast processes	Visibility/ Recordability
Processing	1. **Process error judgment** machines built into lines	Prevention of undetected defects
Inspecting	1. One-piece flow inspections	Improve work performance
	2. Automated inspections on blowhole accuracy of deep hole diameters (Installation of gyro-scanners)	



Precision greatly improved – Shortened inspection time

High-Strength, Air-Tight Products Transcending the Oceans

It was originally suggested to us in 1999 when exchanging opinions with a certain German company during a Kaizen convention that if air-tight gravity products were converted to KSK's **high-strength, air-tight diecast products** it would be possible to **reduce both weight and cost**. We submitted a quotation for exporting valve housings, and they were highly acclaimed for reducing weight by approximately 30% or more and because of their low cost, and the company started importing them from Japan in 2001.

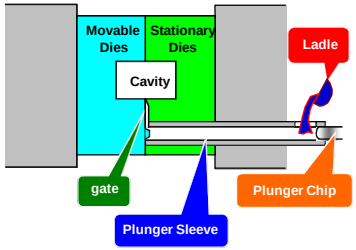
Ever since then we have initiated model changes based on the same levels of stable quality, and we have continued to supply them now for more than10 years.

Valve Housing

Example of Conversion

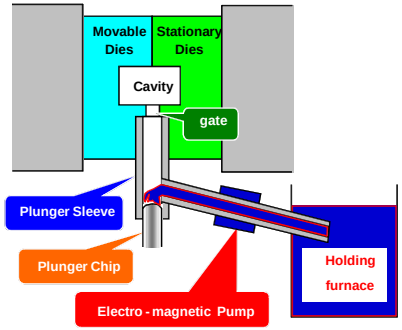
High Strength, Air-Tight products

Cold chamber machine



- Horizontal die closing and horizontal injection
- Ladle melt feed system

Semi hot chamber machine



- Horizontal die closing and vertical injection
- Electromagnetic pump melt feed system

Special features of semi hot chamber diecasting

- Oxideskins and congealed material can almost be avoided by using an **electromagnetic pump** melt feed system.
- Limited blowholes due to horizontal die closing and **low-speed vertical injection** (0.1m/s~0.15m/s).

Products that must have **very low porosity**

- **Strength** 20~30% up, because heat treatment (T6) becomes possible, and **welding** becomes possible too.
- Making **air-tight/oil-tight** parts are possible.

Case for power shift
- **Air-tight** part

Engine mounting
- **High strength** part
- Heat treatment T6

Valve housing for power steering
- **Oil-tight** part

Lighter engine mounts for medium-sized trucks

Aim of Development	**Item**	**Points of Consideration**		**Effect**
	More lightweight	▪ Modified from pressed-steel and cast-iron products to aluminum die-casting products. ▪ High levels of strength made possible by semi- hot chamber die-casting. ▪ High density made possible by vertical injection at low speeds (0.1m/s to 0.15m/s). ▪ Modified from steel sheet brackets to aluminum die-casting products.		▪ Weight reduced by approx. 55% ▪ Heat processing possible ▪ Few blowholes so higher density products possible
Development Progress	Mass-Production		Recommended Vehicle Types	Patent
Product Outline and Features		**Current Product**	**Developed Product**	
	Configuration Principle	Drawing press processed Steel-made V	Diecast + T6 processing Aluminum diecast-made Weight: 0.9kg	
	Weight	1.8kg	0.9kg	
Cost		100%	100%	
Issues		Restricted to shapes that can be cast.		
Suggested Use		Base BRKTs on lightweight floor shifts that require high strength and high density.		

ENG MOUNTING

High strength and air-tight diecasting parts

Medium duty truck

1 CASE
Mass: 308g

2 FRONT COVER
mass: 490g

4 ENGINE FOOT
mass: 1000g

Light duty truck

3 SPRING SEAT
mass: 690g

5 COVER
mass: 315g

Mercedes E Class

6 VALVE HOUSING
mass: 380g

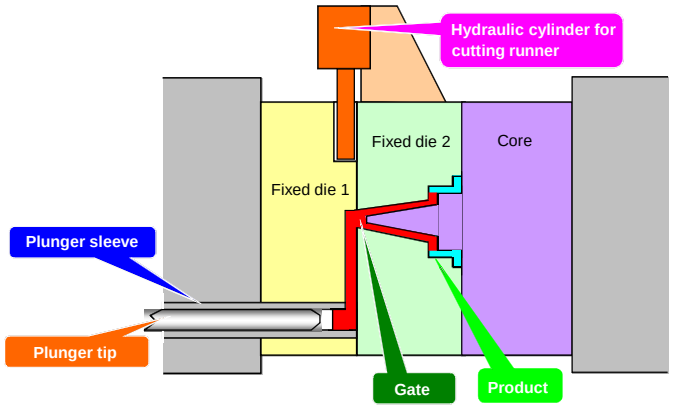
Example of Conversion

High quality diecasting method

Purpose

- Use center gate diecasting method to increase measurement accuracy and to reduce porosity.

Theory of structure



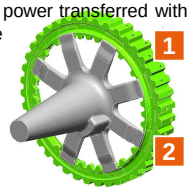
Characteristics

- Realized sprain accuracy by “center gate method” without processing.
- Porosity is very limited.

Parts

- Drum, Piston, Hub, Balancer for automatic transmission.
- Circular parts which need high accuracy.

More light weight for Hub of auto transmission

Aim of Development	**Item**	**Points of Consideration**		**Effect**
	More light weight Anti wear Product accuracy	▪ Modified from steel sheet members to aluminum diecasting parts ▪ High-silicon aluminum die-casting good worth ADC 14 ▪ Centergate diecasting method		▪ Weight reduced by approx. 55% ▪ Strength of surface increasing 15% (comparing against ADC12) ▪ Realized sprain accuracy by "center gate method“ without processing
Development Progress	Mass-Production		Recommended Vehicle Types	Patent
Product Outline and Features		**Current Product**		**Developed Product**
	Configuration Principle	1. Used steel to ensure wear-resistance 2. Drive power transferred by fixed welding 		**Centergate method –** Cog angle of Ø 0.2 achieved without processing **1. High-silicon** – Surface hardness increased by 15% with ADC12 material 2. Drive power transferred with an inner spline 
	Weight	240g (equivalent to the shape of the developed product)		140g
Cost		100%		100%
Issues		Difficult to obtain in large quantities		
Suggested Use		High-precision circular products requiring wear-resistance		

High quality diecasting parts – Centergate diecasting method

ELGRAND

1 **DRUM ASSY**
mass: 1120g

6 **PISTON; DIRECT CLUTCH**
mass: 447g

MOVE

2 **PISTON**
mass: 182g

5 **PISTON**
mass: 61g

CAMRY

7 **HUB**
mass: 140g

TUNDRA

3 **BALANCER**
mass: 266g

IS350

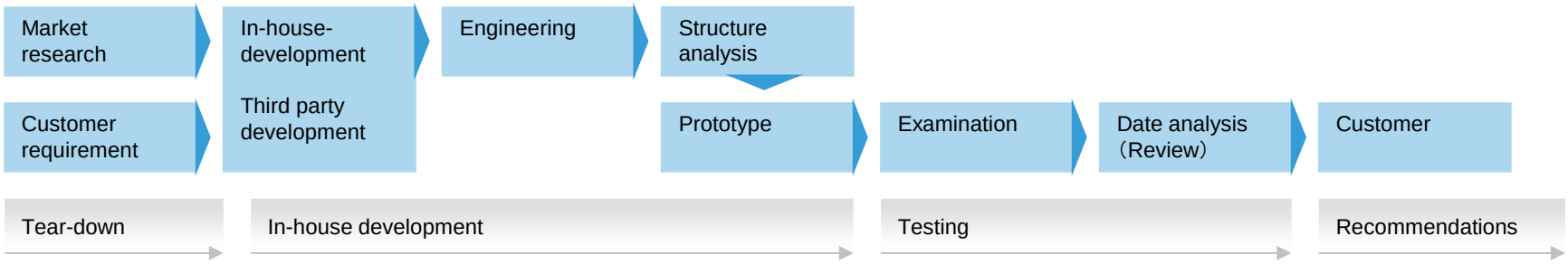
4 **PISTON; BRAKE**
mass: 278g

Consistent Throughout All Stages of Product Development (Processes)

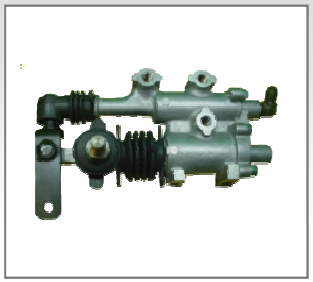
Aiming at becoming a proposal-based company with regard to transmission control.

KSK is forging ahead with the development of a system covering all aspects of product provision, from initial proposals through to design, analysis and test evaluations, in order to satisfy all customer requirements for a wide range of vehicles from light vehicles through to large trucks.

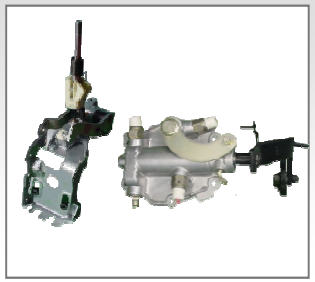
We are aiming at becoming a proposal-based company based on product development that will also satisfy all of our overseas customers.



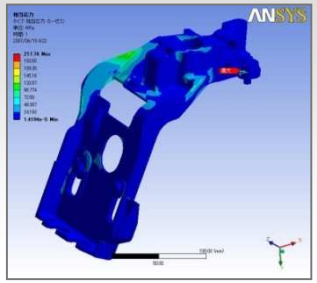
In-house development



Third party development



Structure analysis

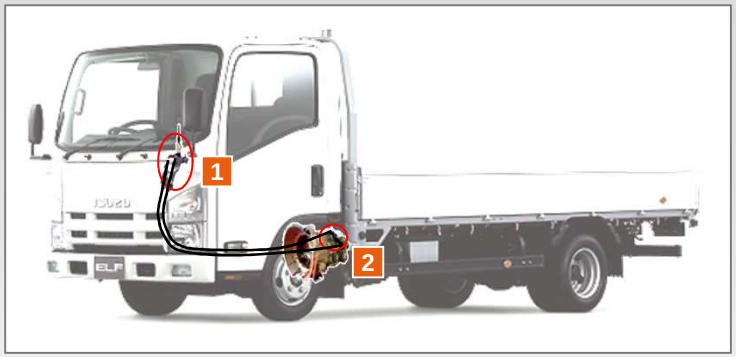


Durability test

Consistent Throughout All Stages of Product Development (Products)

The only one in Japan. We provide all aspects involved in the development and delivery of products, from shift levers through to control boxes, **as part of our overall system**. We also promote the **substitution of materials and specifications in order to achieve more compact and lightweight products**.

In-house development



1 SHIFT LEVER ASSY

2 CONTROL BOX ASSY

3 SHIFT LEVER ASSY

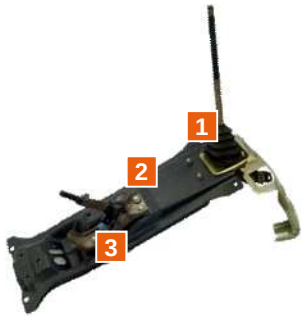
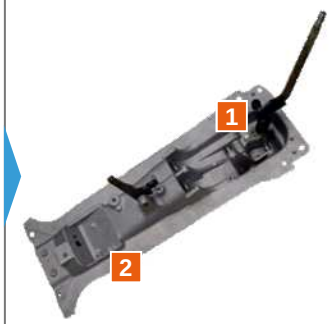
4 POWER SHIFT

Example of Conversion

Lighter Floor Shifts for Light Vehicles

Aim of Development	Item	Points of Consideration	Effect
	More lightweight Cost reductions	▪ Modified from steel sheet members to aluminum die-casting parts. ▪ Costs reduced owing to a unified aluminum form.	▪ Weight reduced by approx. 30% ▪ Cost reduced by approx. 30%

Development Progress	Mass-Production	Recommended Vehicle Types	Patent

Product Outline and Features		Current Product	Developed Product
	Configuration Principle	1. Steel sheet change lever 2. Steel sheet member 3. Transfer lever	1. Small bearings Friction reduced Wobble on top of knob minimized 2. AL unified High rigidity
			
	Weight	3.3kg	2.4kg

Cost	100%	70%
Issues		
Suggested Use	Base BRKTs on floor shifts	

Lighter change levers for small-sized trucks

Aim of Development	Item	Points of Consideration	Effect
	More lightweight Cost reductions	▪ Modified from steel sheet and aluminum brackets to unified aluminum diecasting products. ▪ Cost reductions by simplifying the collapsible mechanism.	▪ Weight reduced by approx. 50% ▪ Cost reduced by approx. 30%

Development Progress	Mass-Production	Recommended Vehicle Types	Patent
		Small trucks, etc.	Yes

Product Outline and Features		Current Product	Developed Product
	Configuration Principle	1. Steel sheet selector bar 2. Aluminium bracket 3. Steel sheet bracket	1. Housing that can be made of resin 2. AL selector bar 3. Unified AL bracket
			
	Weight	2.6kg	1.3kg

Cost	100%	70%
Issues	Aluminium-made shift levers	
Suggested Use	Change levers BRKTs on passenger vehicles and trucks	

Change Lever Parts – Passenger Cars

ATRAI

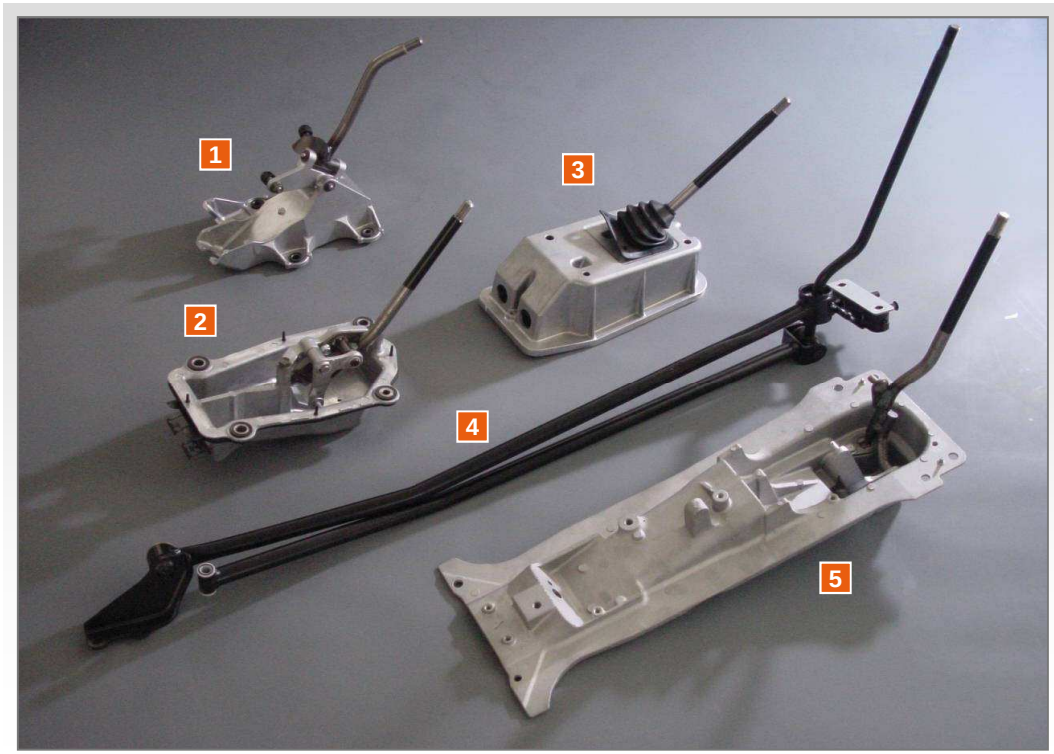
1 MT LEVER: INPANE TYPE
mass: 1350g

XENIA

2 MT LEVER
mass: 1320g

MOVE

4 MT LEVER
mass: 2340g



COPEN

4 MT LEVER
mass: 2340g

TERIOS

3 MT LEVER
mass: 1640g

HIJET

5 MT LEVER
mass: 2300g

Change lever Parts – Commercial Vehicles

Light duty truck

1 **MT LEVER – FOLDABLE & W/SWITH TYPE**

mass: 1400g

2 **AMT LEVER ELECTRIC TYPE**

mass: 1550g

Medium duty truck

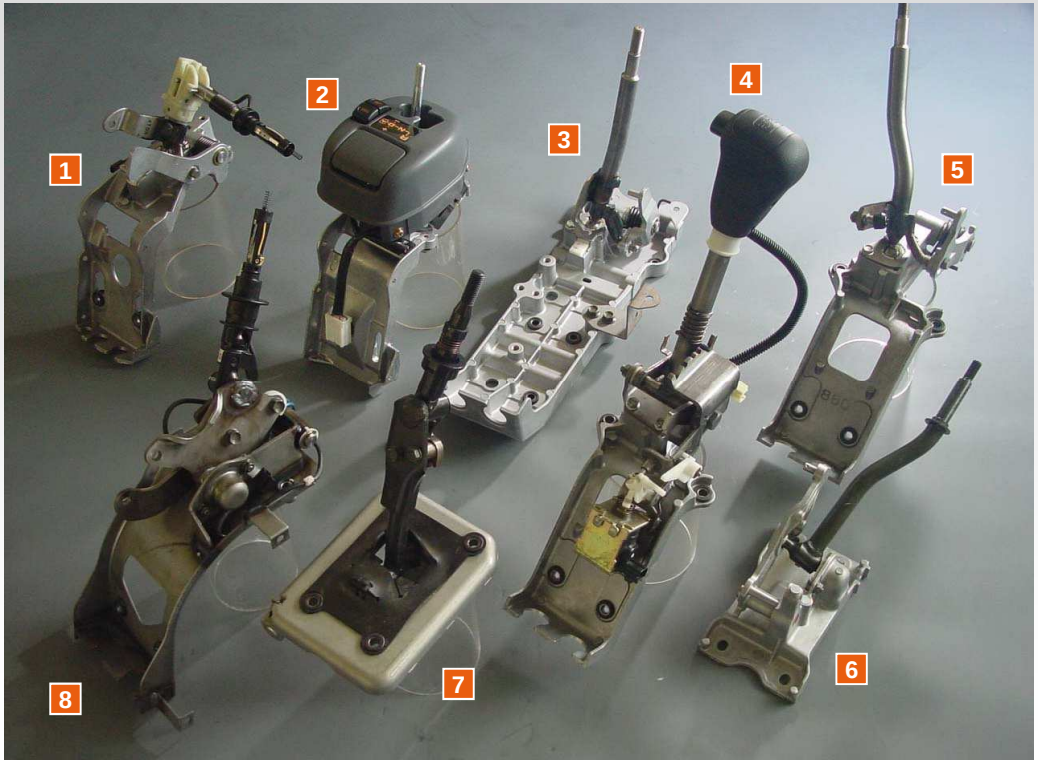
8 **MT LEVER – TILT-FOLD-ABLE & W/SWITH TYPE**

mass: 2800g

Heavy duty truck

7 **MT LEVER – TILT-FOLDABLE TYPE**

mass: 2300g



Heavy duty truck

3 **MT LEVER**

mass: 2280g

Medium duty truck

5 **MT LEVER**

mass: 1470g

6 **AT LEVER**

mass: 3220g

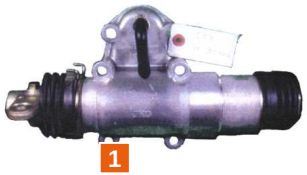
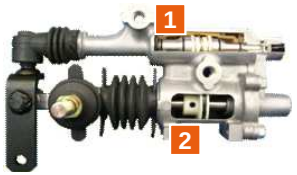
Medium duty truck

6 **MT LEVER**

mass: 1520g

Example of Conversion

Power assistance cost reductions for medium-sized trucks

Aim of Development	**Item**	**Points of Consideration**		**Effect**
	Cost reductions More lightweight	▪ Reducing the diameter of the pistons by separating the valves and pistons.		▪ Weight reduced by approx. 65% ▪ Cost reduced by approx. 30%
Development Progress	Mass-Production		Recommended Vehicle Types	Patent
			Medium-sized trucks	Yes
Product Outline and Features		**Current Product**	**Developed Product**	
	Configuration Principle	1. The valve and piston are located on the same spindle and the diameter of the piston is large  	1. Air switch bubble 2. Piston Separating the valve and the piston will enable the piston to have a smaller diameter to achieve a more compact  	
	Weight	3.4kg	1.2kg	
Cost		100%	70%	
Issues				
Suggested Use		Air-pressure and hydraulic parts		

Control box & Power shift

DMAX

1 CONTROL BOX
mass: 1100g

Light duty truck

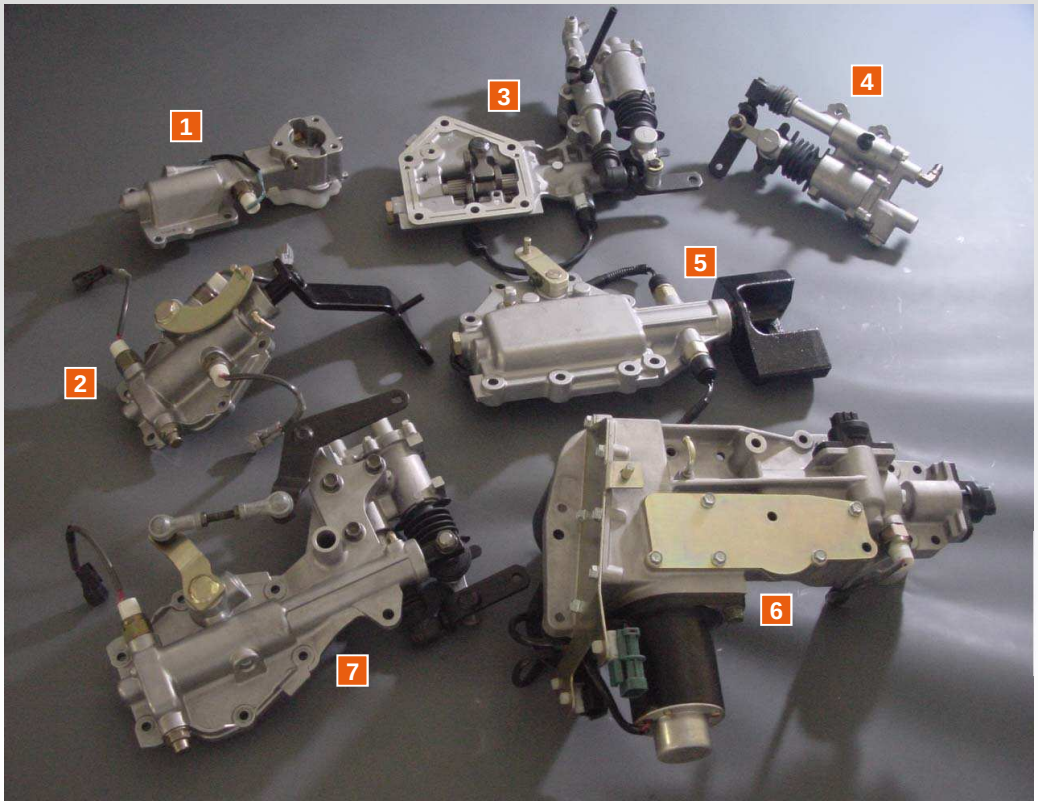
2 CONTROL BOX
mass: 1900g

Medium duty truck

4 POWER SHIFT
mass: 1350g

Heavy duty truck

5 CONTROL BOX
mass: 4200g



Medium duty truck

3 CONTROL BOX
W/POWER SHIFT
mass: 4200g

Medium duty truck

7 CONTROL BOX
W/POWER SHIFT
mass: 4500g

Light duty truck

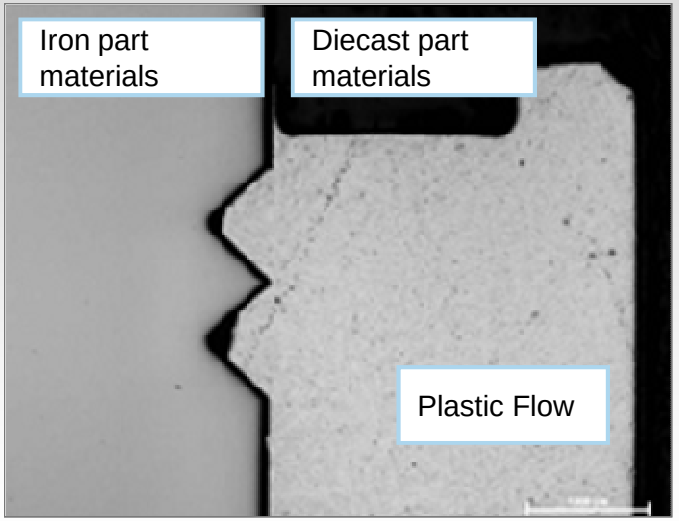
6 CONTROL BOX
W/ELECTRIC ACTUATOR
mass: 17500g

Results of Joint Industrial and Academic Research

The results of the **“plastic binding”** process, in which pressure is applied to aluminum and poured into fine steel grooves in order to obtain mechanical meshing, provide the basis for tangible objects.

Iron part materials and diecast part materials can be bound together. Substituting the plastic binding process for bolted binding has enabled **smaller, lighter and cheaper products**.

(Patent applied for)



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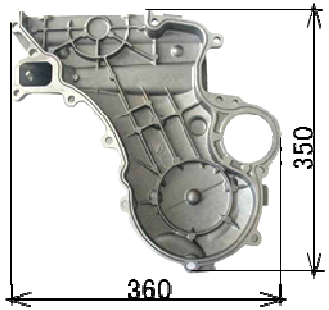
Phone	(49-40) 3861 8956
Facsimile	(49-40) 3861 8985
E-mail	ditzer@interlogue.de

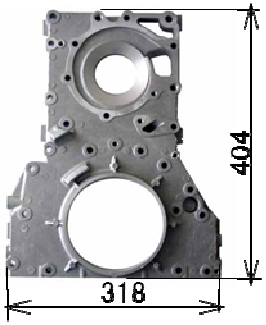
Reference Material: Machines and Products (1/3)

800 ton 4 machines

Engine parts

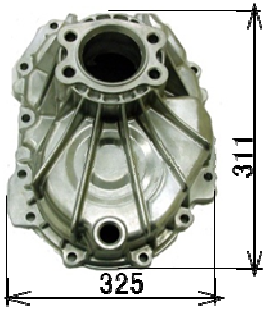


COVER; TIMING CHAIN



COVER; FRONT

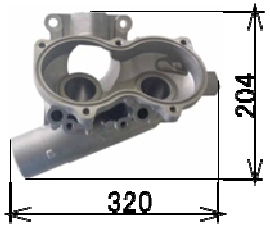
M/T parts



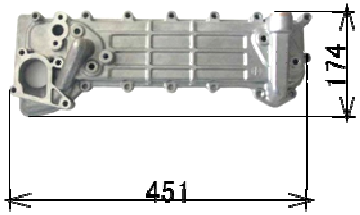
COVER; REAR

650 ton 3 machines

Engine parts

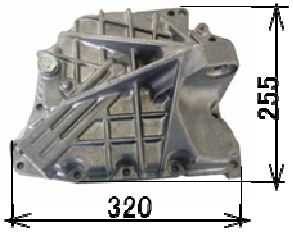


HSG THERMOSTAT



CASE; OIL COOLER

AT-CVT parts

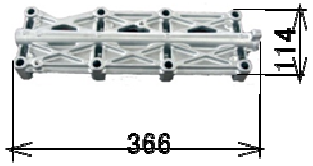


COVER; TRANSAXLE RR

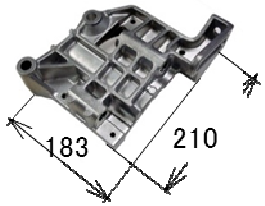
Reference Material: Machines and Products (2/3)

500 ton 2 machines

Engine parts

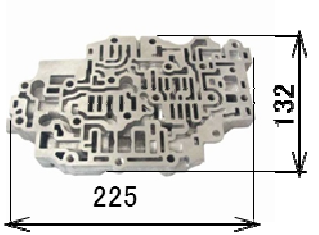


OIL GALLERY



BRKT; COOLER COMP

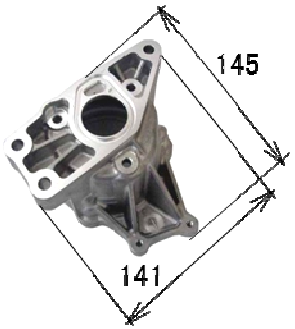
AT-CVT parts



BODY; UPPER VALVE

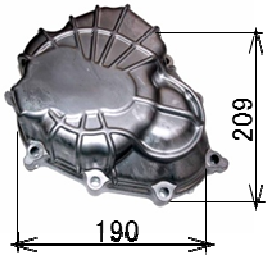
350 ton 16 machines

Engine parts



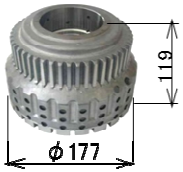
HSG; VALVE LIFT CONTROL

M/T parts

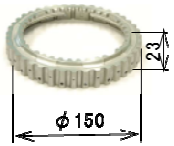


COVER; T/M CASE

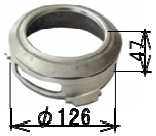
AT-CVT parts (Center gate method)



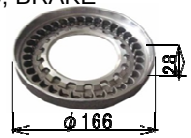
DRUM DIRECT CLUTCH



HUB; BRAKE



PISTON; CLUTCH

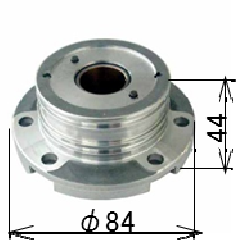


BLANCERCLUTCH

Reference Material: Machines and Products (3/3)

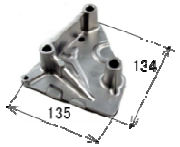
DXHV350 ton 4 machines

Engine parts



COVER; BEARING

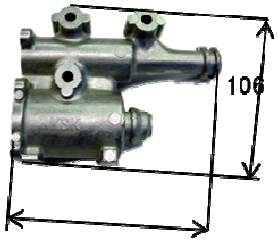
Chassis parts



FOOT; ENGINE

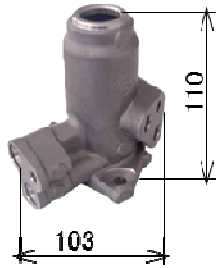
SEAT; SPRING

M/T parts



CASE; POWER SHIFT

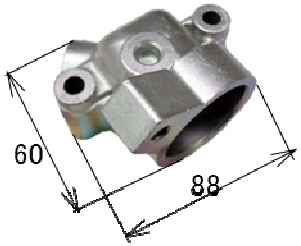
Steering parts



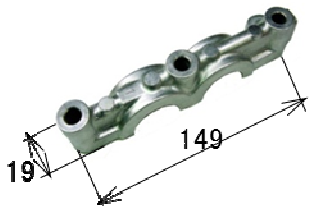
VALVE HOUSING

135 ton 1 machine

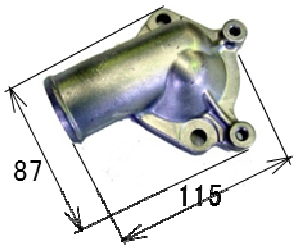
Engine parts



FLANGE; W/I PIPE

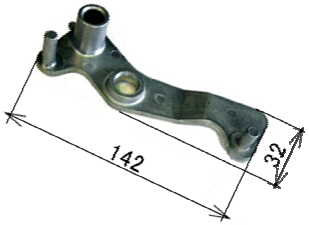


BRKT: CAM SHAFT



PIPE , WATER OUTLET

Shift lever parts



SELECT LEVER

Reference Material: Test Facilities

Vibrochamber

Temperature:
-40°C to +140°C

Humidity
30 to 98%

Capacity size
1.0m x 1.0m x 1.0m

Vibration Test Systems

Acceleration
40G

Frequency
5 to 2500Hz

Ability
1400Kgf

Methods of Compound corrosion Test Systems

Temperature
－40°C to ＋120°C

Humidity
50 to 95%

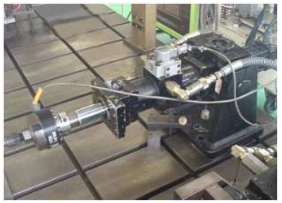
Capacity size
1.0m x 0.6m x 1.0m

Hydraulic Shaker 2 sets

Load
29.4KN

Stroke
±100mm

Cycle
100Hz



Test Bench

3.0m x 4.5m
2 pieces

Pit

gvw
Max 8ton