Product Introduction

Introduction of Development of KYB K'lassic (SD-2)

SAWANISHI Toshiyuki, HOSHINO Yuta, YAMAOKA Koji, ISHIMARU Nozomi

1 Introduction

Aftermarket shock absorbers (hereinafter referred to as aftermarket SA) now produce a core profit of KYB.

In this article, outline of the development of KYB K'lassic*1), a new series of low-price range products which KYB has not manufactured before, is explained.

*1) Coinage of KYB+Classic

2 Background

2.1 Market of aftermarket SA and aim of new product

At KYB, the production volume of aftermarket SA is about one fourth of the total volume and most of the aftermarket SA products are shipped to foreign repair markets.

After market SA products can be classified by type of markets. Those for general-price product markets are called SD-1 and those for low-price range product markets are SD-2 (Fig. 1). The market size of SD-1 is 63,000 thousand pcs/year and that of SD-2 is 19,000 thousand pcs/year. KYB has a share of about 30% of the SD-1 market but has no share in the SD-2 market since KYB has not manufactured SD-2 products.

Demand for SD-1 arises in three years after a vehicle begins to be sold, reaches a peak in three years after the sales of the vehicle ends, and almost disappears in 15 years after the end of the vehicle sales (Fig. 2). Since the vehicle is still new during the period of 5 years after the end of the vehicle sales, general price products are demanded in many cases. This is the SD-1 market.

As the vehicle becomes old and the vehicle price decreases, customers tend to choose lower cost products. Also in case of low-price Korean and Chinese vehicles, low-price range products tend to be chosen even for new cars. This is the SD-2 market.

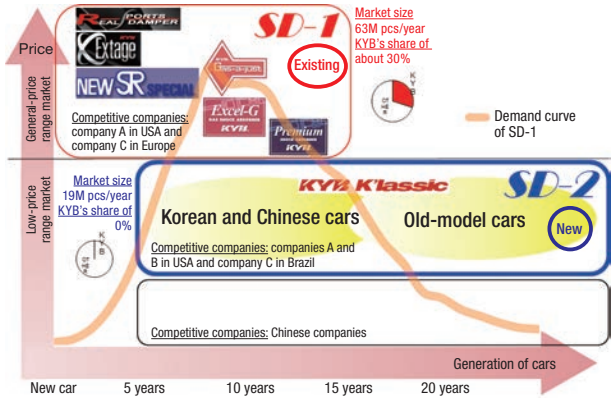

Fig. 1 Aftermarket SA market

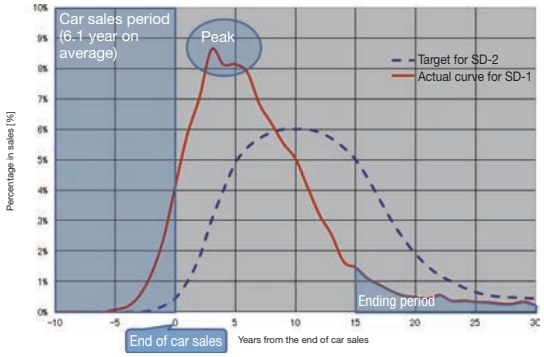

Fig. 2 Demand curve

So far KYB had to make price adjustment to compete with low-price range products of other companies but has begun to develop SD-2 products to cover the low-price range market. The company began to develop products for the SD-2 market while ensuring the reliability and quality but reducing the cost, and aimed to achieve 1,800 thousand pcs/year and share of about 10% by 2020.

2.2 Cost reduction of aftermarket SA

To follow the market price, KYB continues the cost reduction activity every day, which is the basis for the SD-2 development. Part of the activity is explained below.

2.2.1 Improvement activity for low profit models

"Improvement activity for low profit products" is the cost reduction activity with focus on the profitability of a product. Based on the sales record of the previous year, about 10 models having low profitability are selected and cost reduction is aimed at for each of the models. Drawings, unit prices of parts, and production processes are reviewed to solve problems in the production and

replace high-price parts with lower-price ones. By doing this, items having a large cost reduction effect per product are identified. Also, price adjustment for individual models is made by taking account of the market prices.

2.2.2 Cost reduction activity for SD-1

Cost reduction activity for SD-1 is the activity for whole aftermarket SA products conducted with an aim at a wide effect of cost reduction by, for example, changing damping force valve or standard parts. To accelerate the effect, items with higher feasibility are prioritized.

3 SD-2 product development

3.1 Requirements for SD-2 products

There are three requirements for SD-2 products: 30% reduction of sales price, ensuring minimal functions, and differentiation from conventional products.

SD-1 products are manufactured to have the same quality as the one achieved by OEMs but such quality is not necessary for old vehicles in many cases. Therefore, the existing design specifications needed to be significantly revised for the development of SD-2 products.

For the 30% reduction of the sales price, the reduction target of the variable cost was set to 10% to secure the profit. Previous cost reduction activities focused only on the cost reduction while keeping the product functions. However since the previous cost reduction method shown in 2.2 is not suitable to reaching the cost reduction target of SD-2, it was necessary to decrease the variable cost by limiting the functions to necessary ones (like removing excess fat from body). Minimal but necessary functions for ride quality, controllability, strength, durability, and noise prevention were ensured.

It is also necessary to differentiate low-price range products from the previous ones. The differentiation is made by adjusting the damping force. Namely, the damping force is adjusted so that the new products can be clearly differentiated from the previous ones while the deterioration of ride quality is allowed.

3.2 Setting of target performance

A target for each required performance, designated to ensure minimal functions and differentiate the new products from the previous ones, is summarized in Table 3. The ride quality and controllability were allowed to decrease by 25% from those of the previous products. In particular, for the ride quality, clear difference from the previous products was demonstrated with appropriate setting of the damping force. The product strength was maintained in the same level as that of the previous products. The durability and noise prevention were set to an appropriate level as low-price range products.

As mentioned above, the previous cost reduction activities cannot reduce the cost to meet the target. Therefore, a study meeting for cost reduction items was held and the items were identified based on unconventional idea of design (Fig. 4). Next, for each of the items pointed out in the meeting, compatibility with the required performance is checked (Table 1) to establish

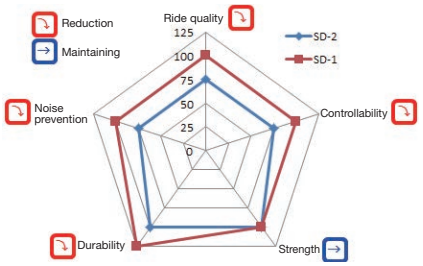

Fig. 3 Setting of target performance

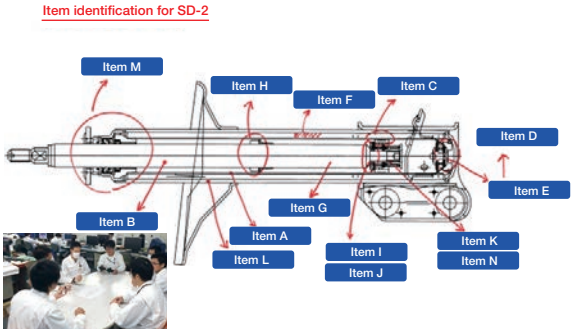

Fig. 4 Item study meeting

Table 1 Check of compatibility with required performance

Item	Cost (◎Large effect ○Medium effect △Small effect)	Performance: Ride quality (Differentiation Minimal)	Performance: Controllability (Minimal)	Reliability: Strength (Unbreakable)	Reliability: Durability (No leakage Minimal)	Reliability: Noise prevention (Minimal)
Item A	◎	—	—	★	—	—
Item B	◎	—	—	★	★	—
Item C	◎	☆	☆	—	★	□
Item D	◎	☆	☆	—	—	□
Item E	○	☆	☆	—	—	□
Item F	○	□	—	—	—	□
Item G	○	—	—	□	—	—
Item H	○	—	—	—	—	□
Item I	○	—	—	—	★	—
Item J	○	—	—	—	★	—
Item K	○	☆	—	—	—	□
Item L	△	—	—	★	★	—
Item M	△	—	—	—	★	—
Item N	△	—	★	—	—	—

★Has to be fulfilled.
☆Needs to be checked.
□Performance to be checked.

design specifications. In particular, for the damping force valve, the number of parts was decreased considerably.

3.3 Tuning of damping force

The damping force valve was also simplified for SD-2 and there could be difference in the following points from the previous products.

(1) Harshness Note 1)
(2) Roll Note 2)
(3) Shock absorption on bad road

Note 1) Vehicle motion when it moves over a joint, protrusion, or step of paved road.
Note 2) Rolling motion to right and left around the traveling direction

The reduction of shock absorption capability on bad road was allowed but the increase of the harshness and roll was adjusted by tuning the damping force to prioritize

the ride quality and controllability (Fig. 5). The positive damping force of SD-2 at around 0.02 m/s was set lower than that of the previous products and the force at around 0.1 m/s was maintained in almost the same level as that of the previous products in order to ensure the ride quality and controllability. The evaluation score was 75.9 with the score of the previous products SD-1 being set to 100 and it was confirmed that the targets of the ride quality and controllability were almost met (Fig. 6). It was also confirmed that the ride quality was clearly distinguishable from that of the previous products.

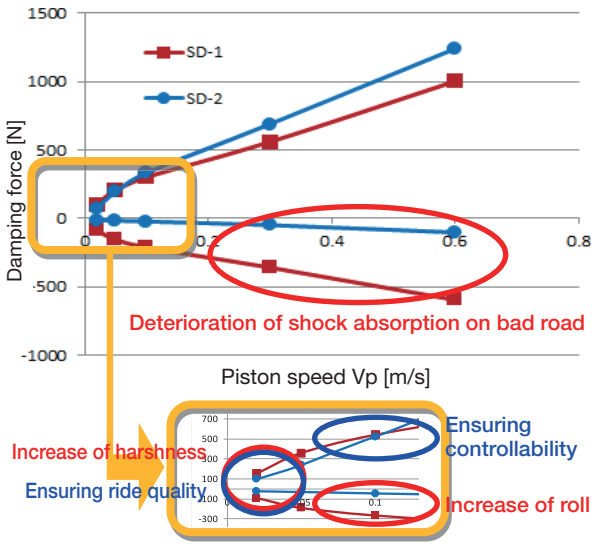

Fig. 5 Characteristics of damping force

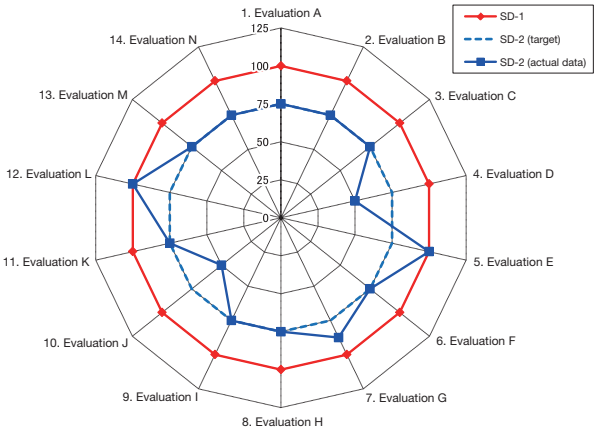

Fig. 6 Evaluation result with actual cars

3.4 Quality check

The durability was tested on actual vehicles to see whether the target quality was secured for each product size. The test result indicated that the target durability was actually achieved. The noise performance was also checked for each product size and found to have no problems (Table 2).

Table 2 Result of quality check

	Quality check items	C25ST	C30ST	C25SA	C30SA
Durability	Item C	Sliding durability test ○	Sliding durability test ○	Mass-produced	Mass-produced
	Item I	Check with C25SA	Check with C30SA	High speed durability test ○	High speed durability test ○
Noise	Noise evaluation A	Noise level measurement Evaluation with actual cars ○	Noise level measurement Evaluation with actual cars ○	Noise level measurement Evaluation with actual cars ○	Noise level measurement Evaluation with actual cars ○
	Noise evaluation B	Noise level measurement Evaluation with actual cars ○	Noise level measurement Evaluation with actual cars ○	Noise level measurement Evaluation with actual cars ○	Noise level measurement Evaluation with actual cars ○

3.5 Driving test in actual conditions

Samples were sent to KYB's sales sites over the world and on-site check of the samples mounted on actual vehicles was conducted (Table 3). The aim of the test was to check the marketability and points of design modification. For the driving test in actual conditions in Iran and Germany, KYB's designers went to the countries and checked the products as well as actual use environment. The driving test in actual conditions in Iran is described in Sec. 3.6.

Table 3 Test result with actual cars

Sales company	Model	Evaluator	Comment from sales company	Conclusion
Germany	European A	Staffs from sales company Designer from KYB	Front product has no problem. Rear product is too soft.	△
			Sent to re-test in Germany	
China	Japanese A	Staffs from sales company and agency	Low controllability but high ride quality Can be commercialized.	○
Asia	Japanese B	Philippines, Myanmar, Sri Lanka	High ride quality with no problem	○
		Thailand, Indonesia, Vietnam	Front product has no problem. Rear product has low ride quality on bad road. Can be improved.	△
Brazil	European B	Staffs from sales company Car owner	Improved stability Slightly soft but no problem in Brazil	○
Mexico	Japanese C	Staffs from sales company	No problem in ride quality Also suitable for taxi companies	○
Middle East	Korean A	Staffs from sales company and agency Designer from KYB	No problem in ride quality, controllability, or noise	○
		Sent to test in Iran		

3.6 Driving test in actual conditions in Iran

In August 2015, a prototype SD-2 was tested on actual car in Tehran, Iran (Photo 1). The car is one of major models frequently found in Iran.

The prototype SD-2 was mounted on the car and it was confirmed that there was no clearance problem between the product and the car. A driving test was conducted and the ride quality and controllability were found to be higher than those of the product previously used for the car.

The total driving distance of the test vehicle was very long (350,000 km) and the products used for the vehicle were extremely deteriorated. Many old cars was found in the city. SD-2 products would be quite suitable in the market of this country to be used for these cars. The market seemed to have a great potential when the economic sanctions had been lifted.

Photo 1 Driving test in actual conditions in Iran

3.7 Cost check

It was confirmed that the target of 30% reduction of sales price and 10% reduction of variable cost could be achieved by taking account of the cost reduction items discussed above. Fig. 7 shows an example of the result of the cost check.

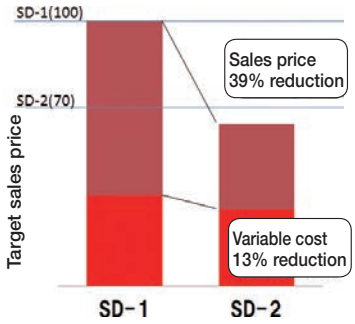

Fig. 7 Cost check

4 Future development

Products developed as SD-2 will be sold as KYB K'lassic and the market target as of 2020 is 1,800 thousand pcs/year (Fig. 8). To achieve this target, more than 400 models of products need to be designed by 2019 and coordination with relevant divisions and departments is being made now. In future, this activity will be developed to foreign production sites.

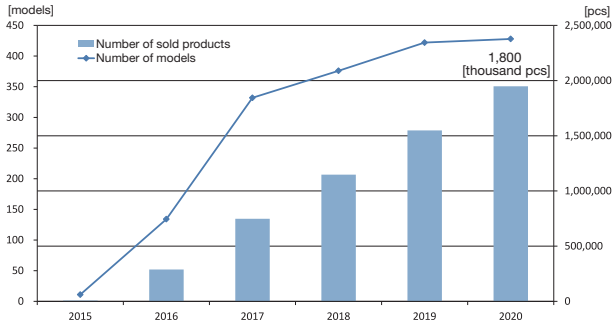

Fig. 8 Future sales plan

5 Conclusions

The outline of the development of KYB K'lassic was explained in this article.

The present activity could develop products suitable for old cars and highly competitive in the low-price range market.

The authors would like to express sincere thanks to those who supported us for the development of the products.

Author

SAWANISHI Toshiyuki

Joined the company in 1998. Design Sect. No.3, Suspension Engineering Dept., Automotive Compponents Opearations. Engaged in the development of shock absorbers for aftermarket products.

HOSHINO Yuta

Joined the company in 2006. Design Sect. No.3, Suspension Engineering Dept., Automotive Components Operations. Engaged in the development of shock absorbers for aftermarket products.

YAMAOKA Koji

Joined the company in 2012. Aftermarket Business Products Planning Sect., Aftermarket Business Headquarters, Automotive Components Operations. Engaged in the planning and development of aftermarket products.

ISHIMARU Nozomi

Joined the company in 2012. Market & Product Planning Dept., Automotive Components Operations. Engaged in product planning and cost planning.