



Aim for Gold Medal in 2018 Pyeongchang Paralympics

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1 Introduction

KYB began providing shock absorbers for Alpen ski sit ski competitions at the Nagano Paralympics in March 1998. It provided shock absorbers and technical support for sit skiing of the national team at the Salt Lake, Torino, and Vancouver Paralympics, contributing to their winning medals.

After the Vancouver Paralympics, KYB's project associated with sit skiing became less active when the national team organization changed, resulting in lack of connection and communication with the national team. Also, a Japan agency of a shock absorber manufacturer in Europe, which had significantly increased its share among the top European athletes, proposed technical support for Japanese athletes. A test was made to check the performance, indicating that these shock absorbers were better than those of KYB. Therefore, the Japanese athletes employed the European shock absorbers, as did the top European athletes, in the Sochi Paralympics.

In this report, we explain our activities to help the national team athletes win gold medals at the Pyeongchang Paralympics in March 2018.

2 Take up the challenge again!

We, as a KYB group member, reviewed past activities and decided to undertake a sit ski project again not only for social contribution reasons but also to improve our technology for developing shock absorbers for sit skis, develop human resources, and establish KYB's brand image.

The design, development, and technical support of sit ski shock absorbers were all entrusted to the Technology Department of KMS (KYB Motorcycle Suspension Co., Ltd., which separated from KYB on October 1, 2013), a department for designing motorcycle shock absorbers that had a long experience history stretching back to the Nagano Paralympics.

The development staff of the KMS Technology

Department joined the training camp of the national team in February 2015. A newly designed shock absorber was delivered to the camp and comments and product evaluations were collected from the athletes (Photo 1).

The national team athletes had extremely high physical ability levels and we almost forget about their disabilities. From their experience as top athletes, they required higher level of specifications than expected for the shock absorbers, which worked as their legs. We found from their behavior and speech that the athletes were "real professionals." So we thought that we could gain their trust only when we put our entire heart and spirit as engineers into the development project.



Photo 1 Test at training camp

3 System improvement for continuous support

KYB became an official sponsor and official supplier of the Alpen Ski National Team of the Japan Para-ski Federation in August 2015.

As official sponsor and supplier, KYB could further strengthen product supply and technical support for athletes of the national team. KYB could also use its logo on the uniforms the athletes and staff wore (Photo 2).



Photo 2 Athletes in kits with KYB logo

4 Product overview

The sit ski shock absorber was developed based on a gas-charged shock absorber for motorcycles. Its cylinder size, gas tank shape, total length, and stroke were all developed for sit skis. Seals and working oil developed for snowmobiles were also used to maintain the performance in extremely cold weather. The gas tank was designed to have a separate tank structure to secure the gas volume as much as possible. The sliding performance was improved by using a **DLC** (Diamond-Like Carbon: See “DLC” on page 58 of the Glossary) piston rod. The operability of the damping force control was improved by employing an integral adjuster^{Note 1)} used in a motocross shock absorber. The state-of-the-art mechanisms of sport shock absorbers were thus used.

In the development, we aimed to make the spring and damping force properties fine-tunable for each national team athlete to extract maximum ski performance (Photo 3).

Note 1) Integrated mechanism of adjustment function of the elongation side damping force and the compression side damping force, which are often positioned separately in conventional shock absorbers, for immediate adjustment on a ski course.



Photo 3 KYB's new type shock absorber

5 Start of development and use in actual events

The development of a new-type sit ski shock absorber began in autumn 2014. At that time, European commercial shock absorbers were ranked highest to use for sit skis and most Japanese athletes used them. For the second challenge, KYB aimed to completely surpass the performance of the European shock absorbers. In the prototype development, we examined the damping force, weight, and other specifications of the competitive products as far as we could.

We had a chance to provide our first prototype to the athletes at the training camp of the national team in Sugadaira Ski Resort in February 2015 and let them try to use the new KYB shock absorber. When the prototype was attached to the frame, the attachment bracket had to be additionally machined. Also, interference between the bracket and the frame, which had not been noticed in a static position, occurred due to insufficient dynamic analysis. However, the shock absorber could be successfully attached with help of the athletes and the test result was highly satisfactory.

After the training camp, the athletes told us that they wanted to use the KYB shock absorber in the next World Championships. So we provided the prototypes of the original form to two athletes including Takeshi Suzuki, a slalom race gold medalist in the Sochi Paralympics. The athletes participated in the World Championships in March 2015 without sufficient training using the KYB shock absorber; however, Suzuki won a gold medal in the slalom race using the new shock absorber.

6 Support for tour abroad

In our re-challenge, we realized success in the first year although we found through the international races some problems with the shock absorber. Intensive tests had been conducted by the end of the 2014/2015 season. Additional tests in a foreign country were necessary because it was difficult to adjust the shock absorber for actual races due to condition problems related to snow and courses.

The new team's first overseas training camp was in New Zealand (Photo 4).

Since we had enough time for the test in the New Zealand training camp, we could communicate with the athletes. Therefore, we could reconsider the national team's reasoning about the shock absorber setting (skiing with the deep stroke position of the suspension kept at a turn). We proposed to realize full performance of the shock absorber by increasing the damping force. The athletes at first felt uneasy but gradually got use to the

setting as they skied. As a result, they understood the potential of the product and the possibility of future performance improvement.

Around that time, the relationship of mutual trust between the athletes and the development staff deepened and both parties could share the direction to pursue. Under this relationship, specification improvements accelerated. As a result, the technological level of the shock absorber became high enough to win a gold medal in technical athletic events such as the slalom.

On the other hand, performance in high-speed events such as the downhill was found to be insufficient in major competitions. At first, we tested the shock absorber with focus on technical events such as the slalom and giant slalom. For these races, the stroke of the suspension should be fully used to absorb ragged snow courses, as in motocross races. However, it was found that the setting concept of the shock absorber employed by the development staff and the Japan national team for the high-speed events was different from that used by overseas high-ranking athletes. In summer 2016, we joined a high-speed race training camp in Chile, South America for specification development and technical support dedicated to high-speed events.



Photo 4 Expedition in New Zealand. Adjustment of shock absorber on ski course

7 Challenge of Takeshi Suzuki

This chapter was written by the Sochi Paralympics gold medalist, Takeshi Suzuki, who entered KYB on August 1, 2015.

The following is the history of Takeshi Suzuki.

1997: Began sit skiing when he was a 3rd grade elementary student.

2003: First participation in Alpen Ski World Championships when he was a 3rd grade junior high school student.

2006: Participated in the Torino Paralympics when he

was a 3rd grade high school student.

2010: Participated in the Vancouver Paralympics when he was a college senior. Won a bronze medal in the giant slalom.

2013: Secured overall World Cup title.

2014: Won a gold medal in the slalom at the Sochi Paralympics and a bronze medal in the downhill.

2015: Secured overall World Cup title for the second time.

7.1 Victory with KYB

When I heard that KYB would restart support of the sit ski national team from the second half of the 2014/2015 season, I was half pleased and half uneasy.

I won a gold medal at the Sochi Paralympics using the European shock absorber and so I initially thought that I wanted to choose the most suitable products for races or courses. However, I also thought that I would not grow as an athlete if I pursued stability.

When I was struggling with this conflict, I saw the development staff working at the training camp and actually used the KYB shock absorber. Then I realized that, with these development staff and the company, we together would be able to develop a new product to win a medal by the next Paralympics. Only a month was left to the World Championships, the most important competition in the season, but we decided to use the KYB shock absorber and removed (cut out!) a part of the sit ski frame and attached the shock absorber to the frame.

Usually, a new type of shock absorber the athletes were not used to would not be used in such an important competition. However, we were not anxious but rather excited.

The result was not very good in the high-speed races, but a gold medal was won in the slalom, which Japan was good at (Photo 5), verifying the high performance of the KYB shock absorber.



Photo 5 Won a gold medal in Alpen Ski Slalom in 2014/2015 season.

7.2 Challenge as KYB employees

After the Sochi Paralympics, I strongly wanted to change my environment. At that time, I was introduced to KYB. However, I had already witnessed the work of the development staff at the training camp in Sugadaira and had thought, “I want to work for a company with these people.” Since I liked cars and wanted to work for a car component company, I decided to work for KYB. I thought that this was destiny.

After entering the Public Relations Dept., Corporate Planning Headquarters, I have tried to advertise KYB through lectures or sit ski race reports. Since I think that KYB’s technology could be used for not only sit skis but also welfare, I would like to be involved in this direction of the business.

7.3 Bonds with development staff

In the 2015/2016 season, we could communicate more with the development staff than in the 2014/2015 season.

Two development staff joined the New Zealand sit ski training camp for the first time and didn’t seem used to the

atmosphere. However, after experiencing some camps, they gained the trust of all the national team members especially in the training camps in Canada and Korea. That time we could talk about many things with them. No other teams had shock absorber technical support staff in the training camps. The athletes of overseas teams were surprised, saying “This is a real racing team!”

7.4 Toward Pyeongchang Paralympics 2018

In the Pyeongchang Paralympics in 2018, we would like to win gold medals in individual events but also see Japanese athletes sweep the podium, which could not be achieved in the Sochi Paralympics.

For this challenge, technologies for not only the slalom and giant slalom, which Japanese athletes are good at, but also high-speed downhill races and the super giant slalom need to be improved.

There are only two years left until the Pyeongchang Paralympics. We would like to do our best to get gold medals and all the other medals with the KYB shock absorber.

Authors



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