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EXPERIENCE OF NATURAL UF6 TRANSPORT FROM CANADA TO JAPAN

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ABSTRACT

Natural UF6 was transported from Canada to Japan using surface and ocean transport.
The surface transport in Canada was made from the conversion facility located in Ontario, Canada to the west coast port in Canada. Thereafter, natural UF6 was shipped by ocean-going dedicated vessel to the Japanese port.
One of the high-light during the transport was the surface transport in Canada which was made through transcontinental transport over the Rocky Mountains aound 4,000km by B-train, multi-trailer combination composed of one tractor with two trailers.

There are many requirements for the surface transport in Canada by transport regulations of both Canada and Japan such as strict inspections on package before shipment by Japanese regulations.
In addition to meet those requirements, we took counter measures especially for the smooth operation of DTC, which is the key issue for securing smooth transport of 48Y cylinders at the time of before loading on truck, before shipment and during surface transport.

As a result of taking counter measures, not only the surface transport in Canada but also the overall transport was successfully completed as scheduled.

INTRODUCTION

Basically, there are two (2) routes for the transport of natural UF6 from the Canadian conversion facility located in Ontario to Japan.
One is to ship from east coast port of Canada to Japanese port through Panama Canal.
The other one is to ship from west coast port of Canada with transcontinental transport over the Rocky Mountains to Japanese port.
Due to several factors such as availability of the dedicated ocean-going vessel etc., we finally selected the route to ship from west coast port which required longer distance surface transport.

In this paper, we would like to introduce the counter measures we took during the surface transport in Canada contributed to the successful transport.

TRANSPORT OF NATURAL UF6

Packaging for natural UF6

For the transport of natural UF6 for Japan, the packaging called as Dedicated Transport Container (hereinafter called as DTC) has been using from 1996.
DTC consists of valve protector, heat resistance caps, flat rack container, cylinder saddles, supporting frame of heat resistance cap (hereinafter called as supporting frame), turnbuckles, special shutters etc.
The weight of DTC loaded with filled 48Y cylinder is around 20 tons and its size is around 6.1m length x 2.4m width x 2.1m height. Since the flat rack container of DTC is certified as ISO 20' flat rack container, DTC can be easily handled.
The combination of valve protector, heat resistance caps and 48Y cylinder is licensed as H (U) package in Japan.
The bird's eye view of DTC is shown in Figure 1.

Operation of DTC for loading 48Y cylinder

In order to load 48Y cylinder onto DTC, special shutters are opened first and thereafter supporting frames are opened. In this situation, 48Y cylinder can be put on cylinder saddles inside of DTC. Then, 48Y cylinder is fastened on flat rack container by turnbuckles.
Then, supporting frames are closed. Since supporting frame holds a heat resistance cap inside of it (refer to Photo 1), 48Y cylinder is covered with heat resistance caps by closing supporting frames. Also, since valve protector is installed inside of heat resistance cap, valve protector is pushed in the skirt of 48Y cylinder.
Then, valve protector is tightly fixed inside the skirt of 48Y cylinder, and heat resistance caps and 48Y cylinder are coupled by fixing devices.
The package preparation is carried out at the same time with loading 48Y cylinder onto DTC.
The above-mentioned operations are carried out in the conversion facility by loading 48Y cylinder onto DTC.

Surface transport in Canada

Transport schedule should be carefully planned well in advance for the successful completion of the transport.
Transport from Canada to Japan is composed of the surface transport in Canada, the ocean transport from Canada to Japan and the surface transport in Japan.
Out of those transports, securing the surface transport in Canada is one of the key issue for the successful completion of overall transport. If the surface transport in Canada, which is the opening of the way to Japan, cannot maintain the schedule, it causes a chain reaction to the following transports.
As for the loading operation at the conversion facility, Inspection Before Shipment should be made at the same time of the loading operation according to the requirement by Japanese Competent Authority. If the loading operation delays, it may bring the delay of the application to the competent authority which cause the delay in receiving green light by the competent authority to start the transport.

As for the ocean transport, securing the schedule of surface transport to meet the pin-pointed window period required by dedicated ocean-going vessel is indispensable to avoid vessel demurrage fees. Moreover, it causes truck demurrage fees and arrangement of temporary storage facility, since storage of DTCs loaded with 48Y cylinders (hereinafter called as loaded DTC) are not allowed both at loading and unloading port,

In order to maintain the schedule of surface transport in Canada, we studied how to take an appropriate counter measures to minimize the following major risks, which may seriously affect the schedule.

1) Loading delay in the conversion facility due to malfunction of DTC
2) Transport delay from the conversion facility to the west coast port in Canada

1) Loading delay in the conversion facility due to the malfunction of DTC

As described in the above “Operation of DTC for loading 48Y cylinder”, the slide of supporting frame is the key to open and close for setting heat resistance caps and valve protector to 48Y cylinder.

If the slide of supporting frame is very hard, it may cause delay in the loading operation of 48Y cylinder onto DTC.

Also valve protector’s height position from the inner bottom of heat resistance cap should be adjusted to the proper height, otherwise valve protector will hit the edge of skirt of 48Y cylinder, then valve protector will not be pushed inside of the skirt.

Those malfunctions of DTC may give a negative impact to maintain the loading schedule in the conversion facility.

In order to avoid the above, we took the following counter measures as a supplementary work;

The maintenance operation of DTC has been carried out every 12 months in Japan. The condition of DTC in last transport has been reflected in the maintenance operation of DTC.

During the maintenance, the side of supporting frame was carefully checked manually whether the roller of supporting frame rotating smoothly or not and grease was poured into all rollers. If roller was not in a good condition, it was replaced with new one.

The roller of supporting frame is shown in Photo 2.

Thereafter, DTCs having supporting frames with smooth slide function were selected for the transport and shipped to Canada.

However, even the selected DTC may have the problem in roller function due to vibration, possible contact with dust and sea water during the transport to the conversion facility. Therefore, the slide function of supporting frame of each DTC was carefully checked prior to its arrival at the conversion facility.

We have experienced several cases that valve protector tend to hit the edge of skirt. In this case, we were obliged to adjust the height of valve protector in the conversion facility, then, the operation was carried out again. Although valve protector’s height has been already adjusted during the maintenance operation of DTC, this occurrence was happened.

Concerning valve protector’s height position, refer to Figure 2.

As a counter measures, we studied the simple method to check the valve protector's height which can be adjusted in the conversion facility. There is a correlation between the depth made by adjustable handle and height of valve protector. Therefore, the depth made by adjustable handle was measured prior to closing supporting frame. If this depth varied from the original depth, the varied depth was adjusted to the original depth by rotating the adjustable handle.
Consequently, the occurrence of the contact of valve protector to the edge of skirt drastically decreased during the loading operation at the conversion facility.

The above counter measures contributed to decrease the risk of loading delay at the conversion facility.
This improvement has been learned by over 10 years experience of supervising services on the loading operation and the maintenance of DTCs.

2) Transport delay from the conversion facility to the west coast port in Canada

Prior to the actual surface transport in Canada, the transport route (refer to Figure 3) and schedule were carefully planned well in advance. The stop-by points were decided with the organized communication network among trucks, forwarder and us. Based on the network, it was confirmed every day that the actual progress of the transport was exactly in accordance with the schedule.

As for the turnbuckles, we decided to set up check points for tightening of turnbuckles at the half way of the surface transport and just before loading onto the vessel. Since the looseness of turnbuckles may bring a negative impact for the transport
Concerning the check for the tightening of turnbuckles, refer to Photo 3.

Since special shutters were opened in checking the tightening of turnbuckles, we were able to see the condition of loaded DTCs simultaneously.
After that, the condition of loaded DTCs had been kept to be the same condition shipped from the conversion facility. And, the occurrence of loosened turnbuckle was few. For the loosened turnbuckle, we refastened it again.

The above check needed some time, but we set the time for check in the surface transport schedule, and performed the check efficiently. As a result, the check was finished without being over the expected time, and the safe transport was secured from the conversion facility to the west coast port in Canada.

In the future, when we get more experiences for the surface transport in Canada, we will study this check from the reasonable viewpoints, too.

As mentioned above, we studied the risks concerned in the surface transport in Canada, and performed the measures for the risks. After that, the trucks with loaded DTCs were arrived at the west coast port just in time for vessel.

CONCLUSIONS

Securing the transport schedule is one of the key factor for the successful achievement of transport.
The first step is to secure the surface transport in Canada, which is the opening of the overall transport. The delay of the said transport might cause a chain reaction to all the following transport schedules. Therefore, we paid a special attention to the possible risks for the surface transport in Canada. We minimized those risks such as malfunction of DTC through taking several counter measures described in the previous section.

Through the accumulated experience on the maintenance operation of DTC for over 10 years, we could take appropriate counter measures to maintain proper function of DTC during the transport.
We will be continuing to accumulate the know-how on DTC and contributing for safe and on-time transport.

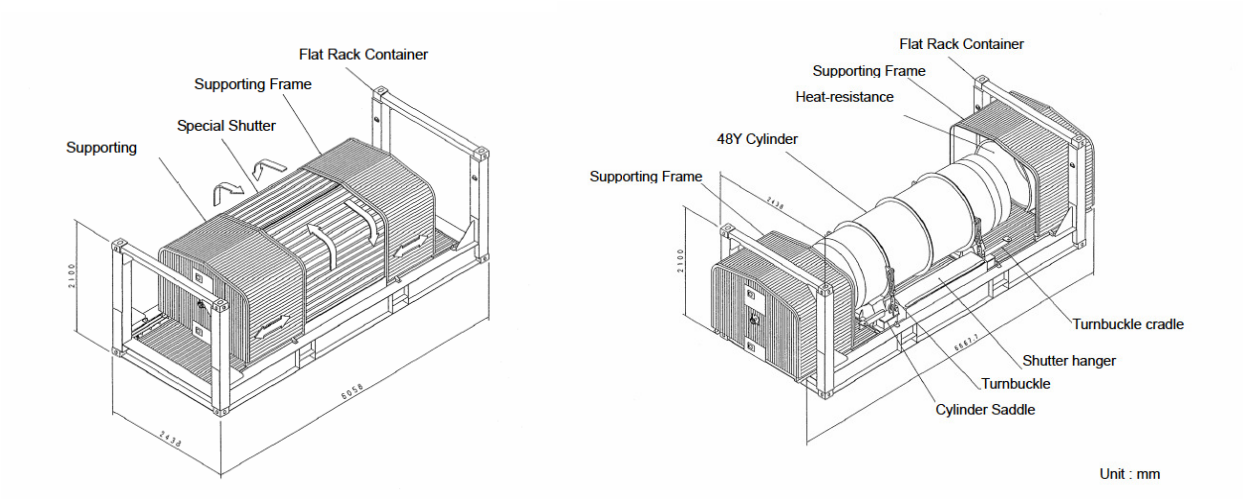

Figure 1. Bird's eye view of DTC

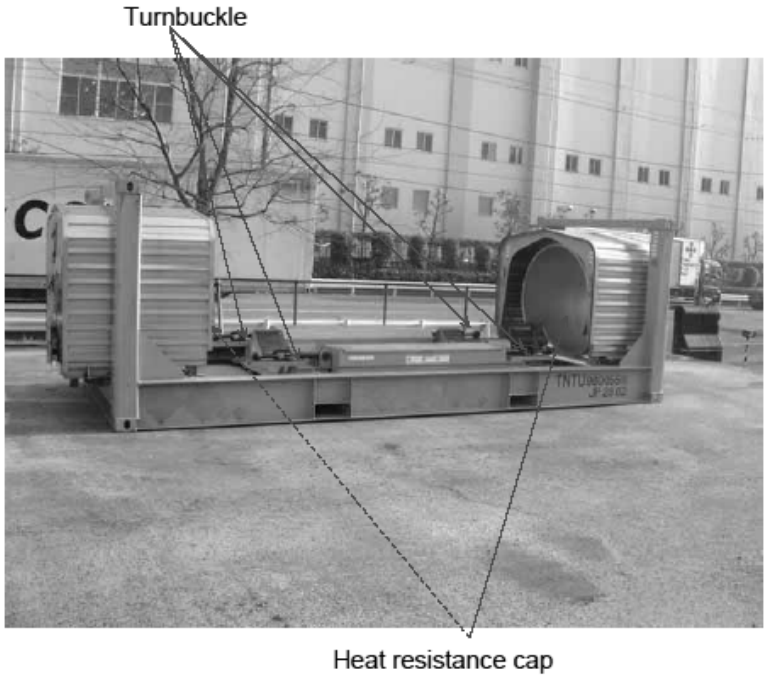

Photo 1. Overview inside of heat resistance cap

Photo 2. Roller of supporting frame

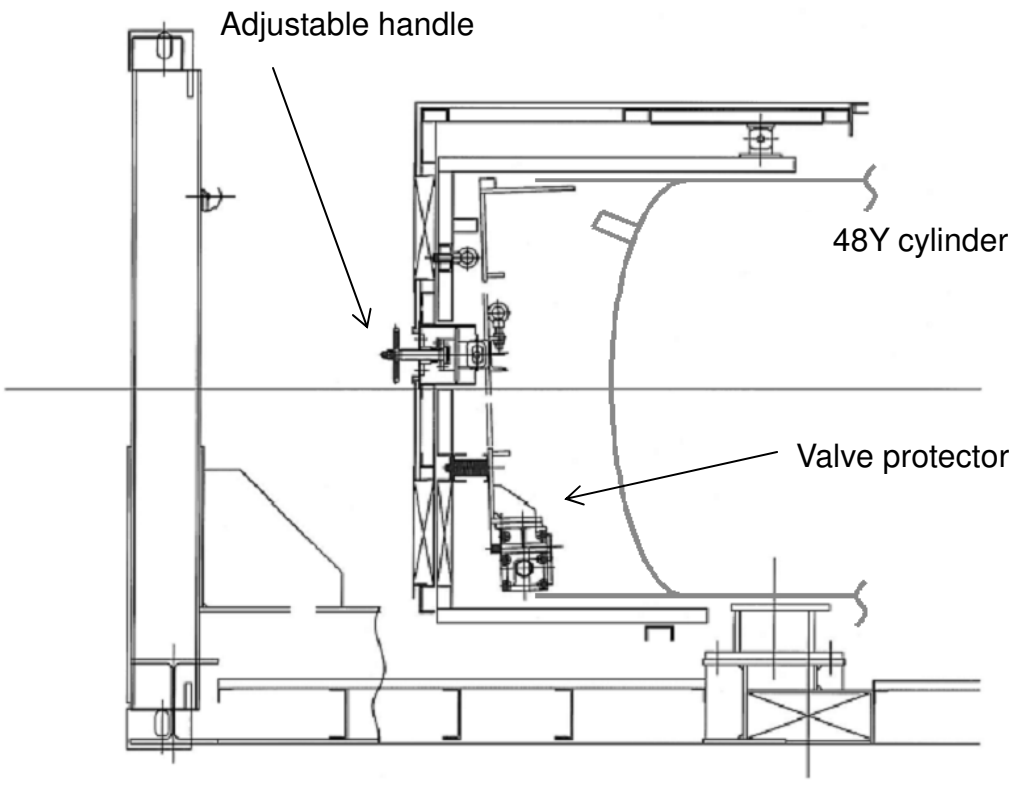

Figure 2. Valve protector's height position

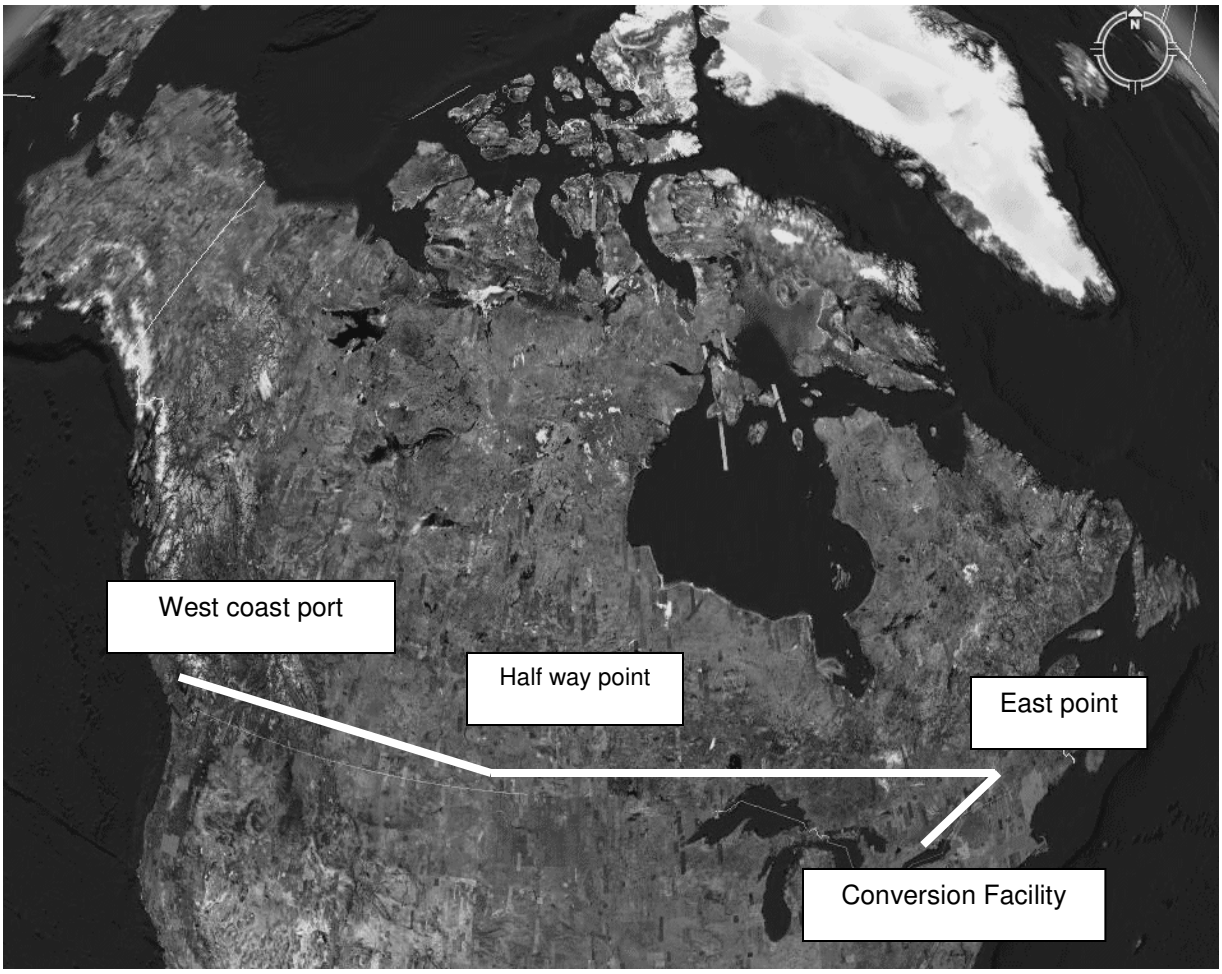

Figure 3. Surface transport route in Canada

Photo 3. Check for the tightening of turnbuckles