

### Ultra-High Tensile Strength Steel (HT100<sup>(Note 4)</sup>)

As the steel penstock of Kannagawa Power Plant is about 1,400 meters in overall length and its difference of elevation between the bottom and the top is about 700 meters, the water pressure in the steel penstock varies from place to place. For example, the water pressure immediately below the headrace surge chamber<sup>(Note 5)</sup> is about 1 MPa, and the water pressure at the turbine is about 11 MPa.

For the construction of the steel penstock, the quality and plate thickness of steel materials are reasonably designed in proportion to water pressures. This time, ultra-high tensile strength steel (HT100) was used as the materials in high water pressure portions for the first time in Japan.

HT100 is usually used as the hulls of submarines, door beams<sup>(Note 6)</sup> of automobiles, etc. As its manufacturing cost is high, HT100 has not been used as the material for steel penstock of pumped-storage power plant. However, as the manufacturing cost has been reduced by the progress of steel-making technology, and it was confirmed by careful performance verification tests conducted together with the manufacturer that HT100 manufactured at lower cost has adequate performance, we decided to introduce it.

As the weight of steel penstock was reduced by using HT100, the period of construction could be reduced by about three months.

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<sup>(Note 4)</sup> HT100 stands for High Tensile Strength Steels. It is a popular name of the steel material, of which the tensile strength is 100 kilogram force per square millimeter or so. It is a special steel that contains nickel, chromium, molybdenum, etc., in addition to carbon that is added to iron in general, and it is rapidly cooled in the cooling process to increase its strength.

<sup>(Note 5)</sup> The headrace surge chamber is a chamber installed near the joint of headrace and water pressure tunnel to prevent a rapid pressure rise in the pressure tunnel due to the water hammer caused by a sudden stop of turbine.

<sup>(Note 6)</sup> Door beams are reinforcements installed inside doors to prevent the doors of automobiles from being deformed at the time of a side-impact collision.

## Cross Section of Water Pressure Tunnel

