

Leakage from the Pipe Flange of the Underground Reservoir No.3: Cause and Countermeasure

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April 12, 2013

Tokyo Electric Power Company

- Date and time of occurrence: April 11, 2013 at 2:03 PM
- Location: Leakage from the **flange** installed near the transfer pump outlet of the underground reservoir No.3 occurred (Dose measurement result: $+ = 0.1 - 28 \text{mSv/h}$).
- Cause investigation: As a result of disassembling the flange,
 1. No abnormality such as a crack, scratch, deformation, etc. was found with the gasket and the flange.
 2. As a result of measuring the gap between flange surfaces, **the amount of gap was found to be inhomogeneous and the crushing amount was found to have been increased.**
- Assumed cause: Decrease in flange surface pressure induced by the change in the tightening condition of the flange due to the air temperature change overtime.
- Countermeasure: After the packing of the flange was replaced at 7:50 PM on April 11 and checking the tightening condition, the flange has been recovered. The contaminated gravels have been removed.
- Measures to be implemented: As for the flanges installed on the transfer lines from the underground reservoirs in which water has not passed through, the **tightening condition of the flanges will be checked** before water transfer and thorough **monitoring for leakage** will be performed during transfer (pump inching, allocate a supervisor and report).

Disassembly of the Flange

- Conditions of the gasket and the flange
 - No defect such as a crack, scratch, deformation, etc. was found.
 - The gasket has been replaced with a new one.



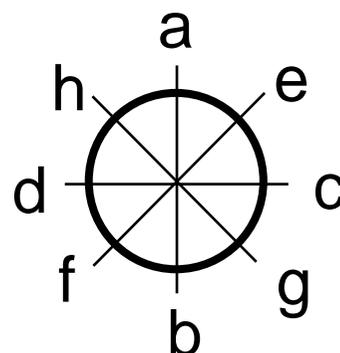
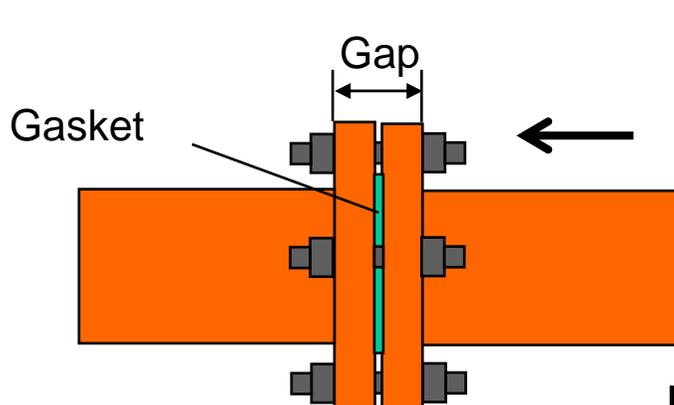
Gap Measurement Performed on the Flange

■ Leakage location

- The gap on the upper part of the flange was found to be larger than other portions.
- The bolts installed on the upper part of the flange were found to be loose.

■ Evaluation of the crushing amount

- The crushing amount at the time of the installation was within the range of 0.13-0.2 (control value).
- The crushing amount measured after the leakage was larger than that at the time of installation.
- Due to the weather conditions (dry winter season) and the temperature change, etc. since the installation on December 25, it is assumed that the tightening condition of the flange was changed (increased crushing amount, loose bolts).



$$*Crushing\ amount = \frac{\text{Tightening amount}}{\text{Gasket thickness (3mm)}}$$

		a	b	c	d	e	f	g	h
At the time of installation	Before tightening (mm)	44.9	44.1	44.7	44.8	44.3	44.7	44.7	44.9
	After tightening (mm)	44.3	43.5	44.1	44.3	43.7	44.2	44.2	44.3
	Tightening amount	0.6	0.6	0.6	0.5	0.6	0.5	0.5	0.6
	Crushing amount*	0.2	0.2	0.2	0.167	0.2	0.167	0.167	0.2

		a	b	c	d	e	f	g	h
At the time of leakage	Before tightening when installed	44.9	44.1	44.7	44.8	44.3	44.7	44.7	44.9
	Measurement before disassembly	44.1	43.3	43.7	44.1	43.5	43.9	43.9	44.1
	Tightening amount	0.8	0.8	1	0.7	0.8	0.8	0.8	0.8
	Crushing amount*	0.267	0.267	0.333	0.233	0.267	0.267	0.267	0.267

Countermeasures

- As for the flanges for which water passing test or air tightness/leakage test has not been done, **gap measurement** and **torque confirmation** will be performed.
- Monitoring for leakage will be performed with the flanges **protected** (with vinyl, etc.) and a **supervisor** and **report method (PHS)** in place during water transfer to allow for prompt suspension of transfer in the case that an abnormality is found.
- When passing water through the pipe, repeat **inching (for about 30 seconds)** a few times before starting regular operation taking into consideration the risk of leakage. **Patrol** will be performed about 30 minutes after the start of operation in order to check for leakage (leakage check).