Outline of Data Center Facility Standard

Formulated by Japan Data Center Council

D a t a C e n t e r F a c i l i t y S t a n d a r d

Japan Data Center Council

http://www.jdcc.or.jp/

(1) Purpose of Formulating Data Center Facility Standard

Along with the increase of introduction of the cloud computing, various types of data centers are requested. For example, one with higher reliability, or one with more eco-friendly and low cost rather than reliability.

Among the standards that define the facility contents to realize required reliability when constructing a data center, “Tier” formulated by a private sector in U.S.A. (Uptime Institute) is known best. However, it is a facility standard built by reflecting global requirement and extensive consideration has not been given to the actual situation in Japan.

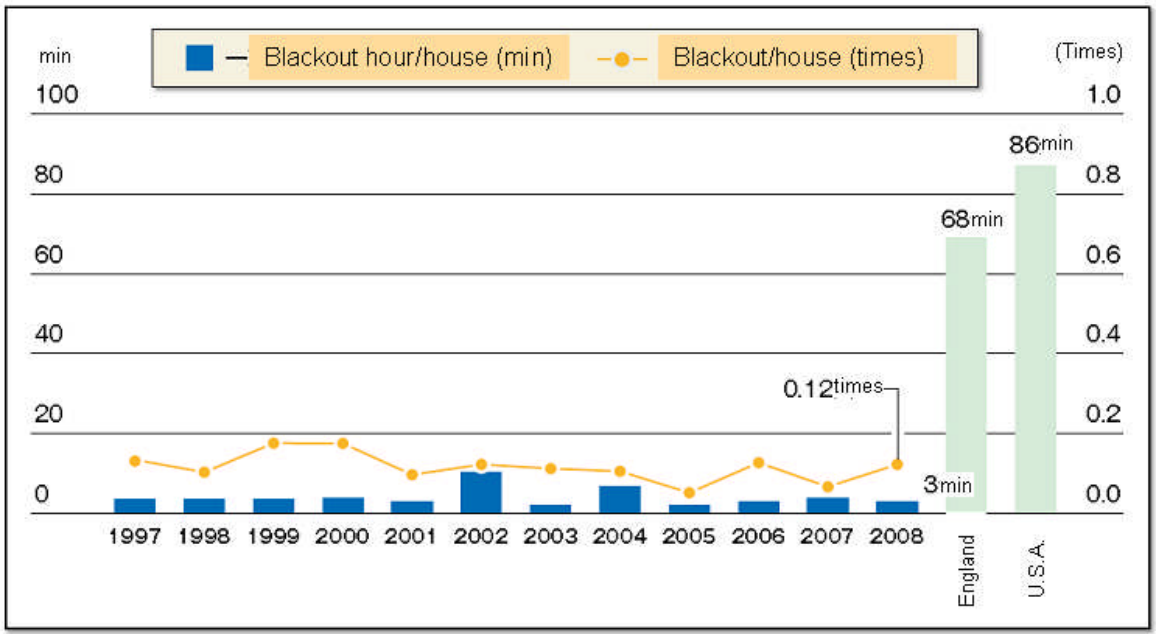
For example, as a basic concept on power infrastructure Tier considers in-house generation to be Primary and positioned commercial power only as its backup. Commercial power supply in Japan has a world-top level of reliability and we believe it is reasonable to take commercial power as the main source and in-house generation as its backup.

Another issue is that we need to consider the higher quality (low failure rate) of Japanese products and the need for earthquake-resistant specifications.

To resolve these general issues, JDCC has formulated the “Data Center Facility Standard,” with the aim of constructing a proprietary facility standard that conforms to the actual situation in Japan. This modifies those portions of the Tier standard that seem excessive for Japan and adds Japan-specific elements.

We plan to actively promote an understanding of this standard. Our goal is that an international understanding of this standard will help to enhance the international competitiveness of domestic data centers, and to have it widely adopted by parties related to data centers including data center users, designers of buildings and equipment, service personnel, construction contractors, and data center operators.

Actual blackout hour in Japan (source: TEPCO Sustainability Report 2009)



(Note) Value from TEPCO excludes blackout due to emergency disaster and planned construction.

England source: Ofgem 「2007/08 Electricity Distribution Quality of Service Report, 2007

U.S.A. source: SAIDI 2008 average of 5 companies, Consolidated Edison, Florida Power&Light, NSTAR, Pacific Gas and Electric, and Southern California Edison (SAIDI：System Average Interruption Duration Index)

Reliability Comparison of the Commercial Power

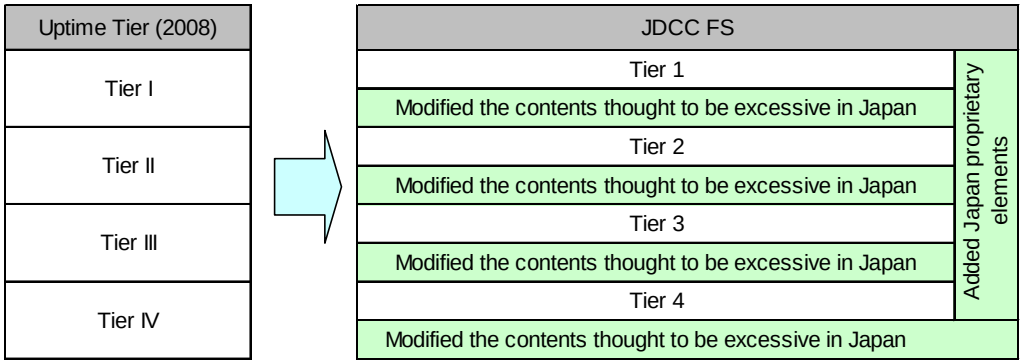
	Commercial power annual blackout (unit: min)	Number of blackout time (time/year)	End user annual blackout time per year (min/year)	End user operation reliability
Japan(TEPCO) worst value in recent 10 years	18	0.18	43	99.99%
U.S.A	86	0.86	206	99.96%
England	68	0.68	163	99.97%

(Note) End user annual blackout time per year (method of calculation)
Calculated based on the assumption that one blackout causes 4 hours of fault for end users.

REFERENCE: Operational Reliability Listed in "Tier Classifications Define Site Infrastructure Performance(Uptime Institute)"

	Total blackout hour of a enduser due to site (min/year)	Operation reliability of a enduser dur to site
Tier 1	1728	99.67%
Tier 2	1320	99.75%
Tier 3	96	99.98%
Tier 4	48	99.99%

Conceptual Comparison of Uptime Tier (2008) and JDCC FS



Service Level of a Data Center Assumed at Each Tier Level

	Service Levels
Tier 1	• Security of a general building level is secured against disasters such as earthquakes and fires. • Equipments are available to offer continuous computing service against momentary interruption of power supply. • Access control to the server room is in effect. • Assumed end users' operation reliability: 99.67% or above.
Tier 2	• Security of a general building level is secured against disasters such as earthquakes and fires. • Equipments are available to offer continuous computing service against long time interruption of power supply. • Access control to the server room is in effect. • Assumed end users' operation reliability: 99.75% or above.
Tier 3	• Security higher than a general building level is secured against disasters such as earthquakes and fires. • Redundant equipments are available to offer continuous computing service even in case of temporary suspension of some equipments such as in case of equipment maintenance. • Access control to the server room and the building is in effect. • Assumed end users' operation reliability: 99.98% or above.
Tier 4	• Very high level of disaster resistance is secured that keeps data maintenance security and availability against earthquakes and fires. • Redundant equipments at higher level are available to offer continuous computing service even in case of fault of some equipments in addition to temporal suspension of some equipment due to failure or maintenance. • Access control to the site, building, server room and IT equipments in the rack is in effect. • Assumed end users' operation reliability: 99.99% or above.

(2) Structure of Data Center Facility Standard

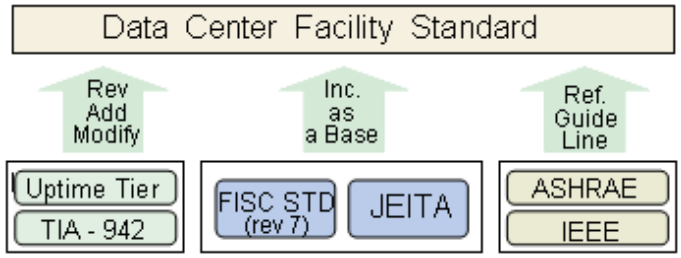
This standard is built by considering compatibility with existing facility standards such as FISC Standard*1 and JEITA Standards*2 that are influential in Japan, and taking overseas standards such as Uptime Tier*3 and TIA-942*4, and provisions in ASHRAE*5 or IEEE*6 as guidelines.

Also, items such as floor height and power capacity that are irrelevant were classified as recommended items. Three items in the right are added as Japan original.

Though it is not reliability related, "Consideration for the environment" that is a social requirement for Data Centers is added as one of the recommended items.

- **Earthquake risk assessment (PML)**
  Overall assessment of earthquake risk such as seismic hazard, stability of the ground, and earthquake resistance of the equipments concerning data center site.
- **Facility risk evaluation**
  If the building is dedicated for data center use. Or evaluation of the security levels, communication network, and facility levels.
- **Operation control risk evaluation**
  Evaluation of the data center management system and operation management.

Structure of JDCC Facility Standard (1)



*1 FISC STD: Security measure standards for computer systems of financial institutions.
*2 JEITA Standard: "Guidelines of Facilities and Equipment for Information Systems (JEITA ITR-1001B)
*3 Uptime Tier: Tier Classifications Define Site Infrastructure Performance (Uptime Institute)
*4 TIA-942Telecommunications Infrastructure Standard for Data Centers (TIA-942-2005)
*5 ASHRAE: The American Society of Heating, Refrigerating and Air-Conditioning Engineers
*6 IEEE: Institute of Electrical and Electronic Engineers

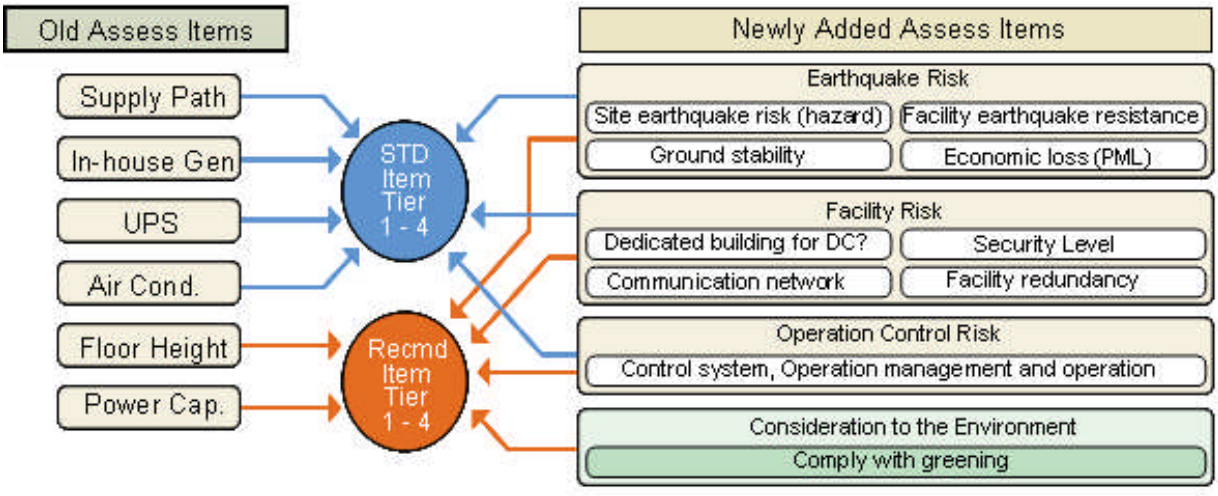
(3) Scope

This standard defines reliability security required for data center facilities by separating "basic items" that are minimum requirements and "recommended items" that are expected to be employed for reliability security.

Upon the application of this standard, "basic items" need to be satisfied for all evaluation items specified in each level of "Tier 1" to "Tier 4". Concerning the recommended items, not all the items have to be satisfied. Each DC can choose any items thought to be required according to the required reliability.

Along with growing introduction of cloud computing, various types of DC are requested such as one seeking the higher reliability, or one pursuing the cost performance or greening rather than the reliability. To respond to these requirements, this standard allows "Multi-tier data center" where each server room in the same data center can have different tier level as well as treating a whole data center as one tier level.

Structure of JDCC Facility Standard (2)



(4) Security Comparison against Earthquake Risks between Japan and US (California)

It is thought that Japan is a country of earthquakes and has higher earthquake risk. However, if we calculate the earthquake strength (maximum acceleration) as a seismic hazard in California that occurs once per 475 years, we get “480cm/sec2” and it is the similar strength(earthquake risk) as in Japan.

On the other hand, Building Standard Law in Japan is seemed as the most stringent building standard in the world. If we calculate PML* for the same buildings built according to laws in U.S.A and Japan respectively, Japan gives lower PML than California, i.e. lower earthquake risk. This means that data center built in Japan has higher security against earthquake than in U.S.A.(California).

Evaluation Result of Earthquake Risk in California and Japan (PML Comparison)

	PML Estimation Result (RC Bldg, 8F)
California	19.8%
Japan	About 15%

* Lower PML means lower earthquake risk.

* PML is an acronym of “Probable Maximum Loss and indicates the damage of an earthquake by a ratio of cost to recover from the damage (including compensation of non-use) vs. the original asset value.

(5) High Reliability of Japanese Products

Reliability of major equipments used in a data centers such as UPS (Uninterruptible Power Supply) and air conditioner, is a significant factor that affects the reliability of the data center facility.

Data centers in Japan generally employ Japan made UPS air conditioners in view of their lower failure rate or higher efficiency. High reliability of these products leads to high reliability of a data center as a whole.

UPS usually used in overseas is said to fail by some reason about once per year at least. Time required to repair and recover is about 24 hours. These can be converted to operation reliability(ratio of continuous operation) of single UPS as 99.7260%(1 – 24/8760). UPS generally used in Japan has higher reliability with down time below 8 hours and gives 99.9087% (1 – 8/8760) operation reliability.

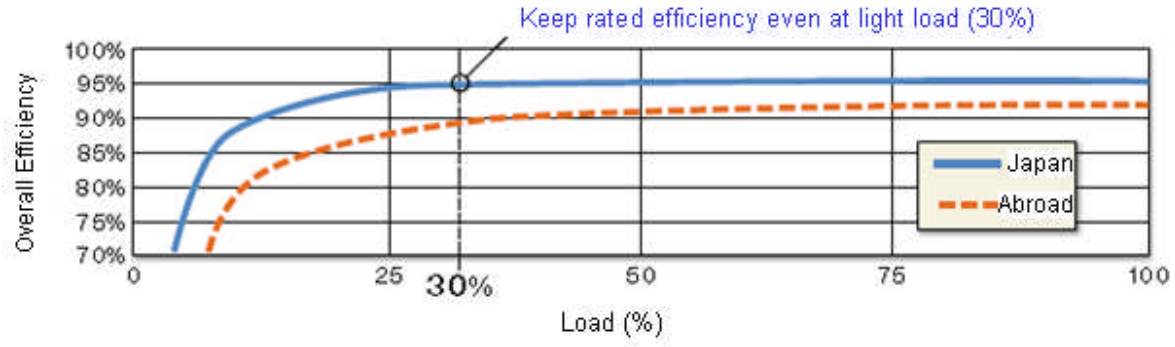
By this, in case of 4 + 1 unit configuration in Japan, operation reliability in Japan is 99.9992% which is the same reliability of 1 + 1 unit (2N) configuration in overseas.

Also, generally used UPS in Japan keeps 95% efficiency under the light load of about 30%, which is about 5% higher than the efficiency of those generally used in overseas.

Operation Reliability Comparison of UPS Systems

UPS system configuration	Operation reliability	
	Overseas (UPS generally used in overseas) UPS fault per year: 24H/unit	Japan (UPS generally used in Japan) UPS fault per year: 8H/unit
In case of 1 unit	99.7260%	99.9087%
Incase of 4+1 unit	99.9925%	**99.9992%**
In case of 1 + 1 unit (2N)	**99.9992%**	99.9999%

Comparison of UPS Efficiency



List of Basic Items

Category	No.	Evaluation Item	Tier 1	Tier 2	Tier 3	Tier 4	Note
Building (B)	1	Use of the building (dedicated for DC or not)	Multiple use Multiple tenants OK	Multiple use Multiple tenants OK	Multiple use Single tenant	Dedicated for DC DC related multiple tenant	
	2	Security against earthquake risk 1) Evaluation based on PML	PML less than 25 - 30%	PML less than 20 - 25%	PML less than 10 - 20%	PML less than 10%	
		2) Evaluation based on Building Standard Act *1 "Comprehensive earthquake-proof planning standards of the governmental facilities" and its pretation(supervised by Government Buildings Dept., MLITT, 1996) High building over 60m or base-isolated building are class I. *2 Estimated seismic intensity of 10% probability occurrence in next 50 years (General Seismic Hazard Map by MECSST)	Complies with Building Standard Act set before 1981. In case earthquake resistance diagnosis judges that reinforcement not required or in case it judges that reinforcement is required and the work has been done.		Complies with Building Standard Act revised in June, 1981.	Complies with Building Standard Act revised in June, 1981 and seismic performance is class II*1.	Below 6 on the Japanese seismic intensity scale of 7*2
			Complies with Building Standard Act set before 1981. In case earthquake resistance diagnosis judges that reinforcement not required or in case it judges that reinforcement is required and the work has been done.	Complies with Building Standard Act revised in June, 1981.	Complies with Building Standard Act revised in June, 1981 and seismic performance is class II*1.	Complies with Building Standard Act revised in June, 1981 and seismic performance is class I*1.	Upper 6 on the Japanese seismic intensity scale of 7*2
Security (S)	1	Security Management Level	Server Room	Server Room	Building, Server Room	Campus, Building, Server Room, Rack	
Electric Equipment (E)	1	Redundancy of Power Receive Line	Single line		Multiple line (SNW, Backup line, Loop)		
	2	Redundancy of power supply path (Power receive equipment to UPS input)	Single path	Single path	Multiple paths	Multiple paths	
	3	Redundancy of power supply path (UPS to server room PDU)	Single path	Single path	Multiple paths	Multiple paths	
	4	Redundancy of in-house power generator	No spec	N	N	N+1	
	5	Redundancy of UPS equipment	N	N	N+1	N+2	
Air Conditioning Equipment (H)	1	Redundancy of heat source/air conditioning equipment	N	N	N+1	N+2	
	2	Redundancy of power supply path to heat source/air conditioning equipments	Single path	Single path	Multiple paths	Multiple paths	
Communication Equipment (T)	1	Redundancy of drop wire path/carrier	Single path Single carrier	Multiple paths Single carrier	Multiple paths Multiple carrier	Multiple paths Multiple carrier	
	2	Redundancy of in-building network	Single path	Multiple paths	Multiple paths	Multiple paths	
Equipment Management (M)	1	Manned management system	No spec	No spec	Manned management over 8 H/day	Manned management 24H/7days	
	2	Operating management system and operation (including training of operators)	Specified operation management system exists	Operation management system including operator training program exists.	In ISO27001 or FISC Operation Standard, complies with items on equip. operation.	Complies with ISO27001 certification or FISC Operation Standard.	

List of Recommended Items

Category	No.	Evaluation Item	Tier 1	Tier 2	Tier 3	Tier 4	Note
Location condition and other risks (R)			In case liquefaction risk is judged as "considerably low" from PL value or by professional judgment.				
	1	Stability of the ground	In case PL result indicates liquefaction risk is "extremely high" or "high" and measures against it such as piles are not performed.		In case PL result indicates liquefaction risk is "extremely high" or "high" and measures against it are performed.	In case PL result indicates liquefaction risk is "low" and measures against it are performed.	
	2	Environment around the facility if it is located in high density residential area of high risk of fire spreading, in an area of explosive facilities, or in an area where access routes for recovery are hard to secure.	It is located but actions are not taken.		It is not located, or located but actions are taken.		
Building (B)	1	Safety for earthquake of installations(equip., piping, etc.) *1 IT equip:. Server rack, free access floor, etc. Critical equip.: Equip to secure function like servers General equip: Equip other than IT and Critical. *2 Estimated seismic intensity of 10% probability occurrence in next 50 years (General Seismic Hazard Map by MECSST)	Correspond to earthquake resistance class B.		IT equip.: correspond to earthquake resist. class A*1 Critical equip: correspond to earthquake resist. class A General equip: correspond to earthquake resist. class B		Lower 6 on the Japanese seismic intensity scale of 7*2
			Correspond to earthquake resistance class B.	IT equip.: correspond to earthquake resist. class A*1 Critical equip: correspond to earthquake resist. class A General equip: correspond to earthquake resist. class B		IT equip.: correspond to earthquake resist. class S*1 Critical equip: correspond to earthquake resist. class A General equip: correspond to earthquake resist. class A	Upper 6 on the Japanese seismic intensity scale of 7*2
	2	System and preparation of early recovery after earthquake is ready in case damage or function stop of the facility(emergency manual, disaster prevention manual, and BCP available)?	Early recovery system/preparation in place		Early recovery system/preparation not in place		
	3	Fire resistance of the building	No spec	No spec	Fire resistant	Fire resistant	
Server room and data storage room (C)	1	Fire resistance, partition	No spec	Dedicated independent fire partition	Resist fire over 1 hour	Resist fire over 1 hour	
	2	Pre-room of the server room	No spec	No spec	No spec	Required	
	3	Ultra high sensitive fire detection in the server room	No spec	Required	Required	Required	
	4	Gas fire extinguishing system	No spec	No spec	Required	Required	
	5	Leak detection system in the server room	No spec	Required	Required	Required	
Security (S)	1	Access control site	No spec	No spec	No spec	Man or IC card	
	2	building	No spec	No spec	Man or IC card + biometrics	Man or IC card + biometrics	
	3	server room	IC card	IC card	IC card (prevent tailgating)	IC card + 10key/biometrics (prevent tailgating)	
	4	rack	No spec	No spec	Key	Key or IC card/biometrics	
	5	Security monitor site	No spec	No spec	No spec	Man, camera, sensor	
	6	building	No spec	No spec	Man or camera (record images or monitoring only)	Man or camera (record images and monitoring)	
	7	server room	Camera (only record of images)		Camera (record of images and monitoring)		
	8	rack	No spec	No spec	No spec	Camera (by rack)	
Electric equipment (E)	1	Electric/UPS room	No spec	No spec	Separate dedicated partition	Separate dedicated partition	
	2	Redundancy of power supply for server room lighting	For commercial only	For commercial only	For commercial + in-house generating equip.	For commercial + in-house generating equip.	
	3	Guaranteed UPS up time	No spec	5 min	5 min	10 min	
	4	Reserved oil quantity (including oil suppliers priority stock)	No spec	12 hour	24 hour	48 hour (24 hour)	Within "()" means for EHV
	5	Redundancy of central monitoring equip.	No spec	No spec	Required	Required	
Air conditioning equipment (H)	1	Partition of heat source mecha. Room	No spec	No spec	Separate dedicated partition	Separate dedicated partition	
	2	Make-up water reserve for air conditioner (for humidification, chilling tower)	No spec	for 12 hours	for 24 hours	for 48 hours	
	3	Redundancy of power supplies for heat source and air conditioner (capable of preventing server room temp during blackout)	No spec	No spec	In-house generator	in house generator (Install UPS if required)	
	4	Redundancy of piping system (in case of water air conditioning)	No spec	No spec	Required	Required	
Communication equipment (T)	1	Partitioning of MDF room and network room	No spec	No spec	Separate dedicated partition	Separate dedicated partition	
	2	Redundancy of MDF room and network room	No spec	No spec	Required	Required	
	3	Redundancy of in-building comm. Equip. (router/switch)	No spec	No spec	Required	Required	
	4	Redundancy of power supplies of comm. equip.	No spec	No spec	Required	Required	
	5	Separation of comm. cable and power cable	No spec	No spec	Required	Required	
Equipment operation (M)	1	Conduct total energy management (including continuous monitoring of power, temp, humidity, etc.)	No spec	No spec	In effect	In effect	

[What is the Japan Data Center Council (JDCC)]

The Japan Data Center Council is an organization formed by data center operators and data center-related operators. Its objective is to support the establishment of IT-based national development by creating the ideal data center with each operator working together vertically and horizontally to resolve issues.

For more information please contact:
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