



Report from the Council for Recurrence Prevention Measures

Total smart exchange

Tokyo Stock Exchange, Inc.

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- On October 1, 2020, a failure occurred in the arrowhead cash equity trading system of Tokyo Stock Exchange, Inc. (TSE), which made it impossible to start trading and meant we were unable to provide opportunities for trading for the entire day.
- In response to this failure, TSE has implemented various measures, such as (i) system-based responses and comprehensive checks, including development of measures for switchover of hardware and conducting tests, and (ii) enhancement of procedures for failsafe trading suspensions. However, the main cause of TSE's failing to resume trading was an absence of rules and procedures for trading resumptions after a trading suspension resulting from a system failure. In addition, various issues were revealed, such as a need for clarification and better transparency of standards and procedures for recovery.
- In order to consider such issues, TSE established and has been holding discussions through a Council for Recurrence Prevention Measures and Specialist Working Group comprised of a variety of market users such as securities companies, investors and system vendors.
- In response to the failure, TSE has decided that as well as continuing efforts to enhance reliability under the slogan "Never Stop", it will focus also on improving "Resilience". Based on these perspectives and the issues highlighted by the failure, the Council decided to consider specific rules and procedures from the following standpoints in order to create an environment that enables a quick and smooth resumption of trading.
 - Allowing a quick and smooth response by establishing specific rules and procedures in advance for a) the steps to be taken for a trading suspension when a failure occurs, b) decisions on whether to implement a trading suspension/resumption, and c) the overall preparation process for a trading resumption.
 - Enhancing transparency and foreseeability for investors and other market users by clarifying standards and procedures for determining trading resumptions, etc.
 - In addition, when enacting trading resumptions, conducting market operations while giving full consideration to ensuring appropriate price formation and securing the safety of trading and settlement
 - Enhancing information provision in the event of a system failure to disseminate information widely among investors and other market users and enhance foreseeability
- By developing these rules and procedures, TSE is just at the starting line – we are determined to improve resilience of the market on an ongoing basis, by carrying out system failure drills with market users while constantly reviewing the new rules' effectiveness and carrying out improvements.

-We also plan to consecutively introduce changes for JPX's derivatives markets, in principle in line with this report.

1. Outline of Responses



I. Development of Rules and Procedures for Trading Suspensions and Resumptions, etc.

- ✓ In order to enable a smooth trading resumption after a system failure, clarify specific policies for trading suspensions in line with the failure situation and develop rules in advance for handling, etc. of customer orders by trading participants in the case of order cancellation by the Exchange
- ✓ Develop specific operational procedures in the event of a reboot of the Exchange's trading system ("reboot and reset")



I-1. Clarification of policies for trading suspension in the event of a system failure (to be implemented in April 2021)

- Determine policies for trading suspensions that are in line with the failure situation, in order to enable smooth preparation for a trading resumption.
 - If the operational impact of order acceptance cannot be foreseen, implement trading suspension with orders not accepted.
 - Provide multiple ways of implementing trading suspensions and specify their order of priority based on the ability of trading participants to respond.

I-2. Order cancellation by the Exchange and handling, etc. of customer orders when this occurs (to be implemented in April 2021)

- In cases where order cancellation would contribute to a smooth trading resumption, manually invalidate already accepted orders to resume trading.
- Organize and clarify rules for handling of customer orders by trading participants in the event of order cancellation by the Exchange.
 - Clarify in the rules that the Exchange may cancel orders. In addition, clarify in the rules that trading participants should in principle resend customer orders in the case of order cancellation by the Exchange, but that alternative agreements are also allowed. (Set out examples of and comments on types of orders for which resending could be considered undesirable and communicate this widely.)

I-3. Development of rules and procedures for trading resumption by system reboot (to be implemented in steps from April 2021)

- In cases where a system reboot is necessary to resume trading, consider aiming for trading resumption through a system reboot as an acceptable course of action.
- In order to enable a smooth trading resumption even in the case of a system reboot, implement necessary system responses (e.g. adjustments for order information management), as well as organize and communicate points to note for trading after the resumption (e.g. the base price, application of short selling restrictions).
- To prepare for a system failure during the trading session, develop a method to confirm the status of executions from before the failure between the Exchange and trading participants.

I-4. Conducting drills (started in January 2021 and ongoing)

- Conduct drills for I-1 through I-3 above from April 2021 to improve the effectiveness of operations and to enhance the resilience of the market.

II. Clarification of Standards and Procedures for Trading Resumption under the Contingency Plan

- ✓ Enhance foreseeability and transparency of market operations in the case of an unforeseen event by clarifying standards for determining trading suspensions and resumptions.
- ✓ Clarify procedures for checking with trading participants on the possibility of their participation in trading (opinion gathering) to enable a transparent and effective process for determining trading suspensions and resumptions.

II-1. Clarification of standards, etc. for trading resumption under the Contingency Plan (to be implemented in April 2021)

- When determining trading suspensions and resumptions, in order to ensure a certain level of liquidity and investor diversity, establish standards for the share of retail trading (approx. more than 30%) and the number of trading participants brokering retail orders (5 or more), in addition to the share of trading value in the entire market (approx. more than 50%).
- Secure at least 15 minutes for order acceptance time and trading hours in order to resume trading, in consideration of fair price formation and liquidity.
- In the event of a natural disaster, determine trading suspensions/resumptions based on discussions with the relevant authorities and related organizations.

II-2. Development of procedure for gathering opinions on trading resumptions (to be implemented in April 2021)

- Implement a process where opinions are gathered from all trading participants through persons responsible for securities trading and clarify this in the rules.

III. Enhancement of Information Provision

- ✓ Establish an information provision policy for when a system failure occurs to enable investors and other market users to access details of the system failure and the recovery situation in a timely and appropriate manner.

(Implemented in February 2021)

- Widely communicate information by creating a dedicated web page on the JPX website to collate and disseminate it, as well as using social media.
 - Develop rules in advance on the frequency of updates and the information contents and disseminate the information based on these rules. Operations began with a test run as part of system failure drills in Jan. 2021 and went live in Feb. 2021.

2. Development of Rules and Procedures for Trading Suspensions and Resumptions



If the Exchange cannot foresee the impact of the system failure and determines that trading of all issues may be affected, TSE's basic policy will be to not accept orders for all issues (non-acceptance will be carried out through the following measures where possible and in order of priority):

Priority	Before Starting Order Acceptance	After Starting Order Acceptance (including during trading hours)
1	<p>Change the start time of order acceptance and do not send the market administration message (Order Status: Accepting Orders) at the normal time.</p> <p>*Orders placed in this situation are returned as errors (Outside Order Acceptance Hours). *A market administration message (Order Status: Accepting Orders) is sent out at the altered start time of order acceptance.</p>	<p>Send the market administration message (Order Status: Outside Order Acceptance Hours)</p> <p>*Orders placed in this situation are returned as errors (Outside Order Acceptance Hours). *A market administration message (Order Status: Accepting Orders) is sent out when resuming order acceptance. *The number of market administration messages per day would be different from a normal trading day (more due to suspension/resumption)</p>
2	<p>Disconnect virtual servers before the start of order acceptance.</p> <p>*A market administration message (Order Status: Accepting Orders) is sent after connections are recovered.</p>	<p>The following two measures will be carried out in sequence:</p> <ul style="list-style-type: none"> - Do not send the market administration message (Order Status: Outside Order Acceptance Hours) and do not accept orders *Orders placed in this situation are returned as errors (During Temporary Halt). *Warning Information Message (Warning Information Type: Trading Halt (Not Accepting Orders)) is sent. In addition, in FLEX, an ST tag (Not Accepting Orders) is disseminated. *Warning Information Messages are sent to notify of resumption of order acceptance and trading. - Disconnect virtual servers *A market administration message (Order Status: Accepting Orders) is sent after connections are recovered.

If the failure situation means neither of the above measures can be taken, TSE may stop orders being sent on a trading participant or virtual server basis, to avoid orders being accepted and invalid order executions being generated as a consequence.

Action required by Trading Participants

- When the Exchange conducts the above measures, trading participants will be expected to immediately restrict order placement in order to finalize which orders will need order placement when order acceptance is resumed, but only after checking for information such as a market administration message, a warning information message, the reason for orders returned as errors, FLEX information, and system failure notices provided by the Exchange. Also, trading participants will need to clarify in advance how they will handle orders returned as errors up to and when trading resumes.
- The above measures will be taken when the Exchange determines that a failure may affect all issues. However, if the Exchange determines that only some specific issues may be affected (in cases such as a failure in a part of trading servers), since trading may be suspended (orders not accepted) in those specific issues (the market administration message will not be sent with any placed orders returned as errors), in this case trading participants will need to take the same actions.

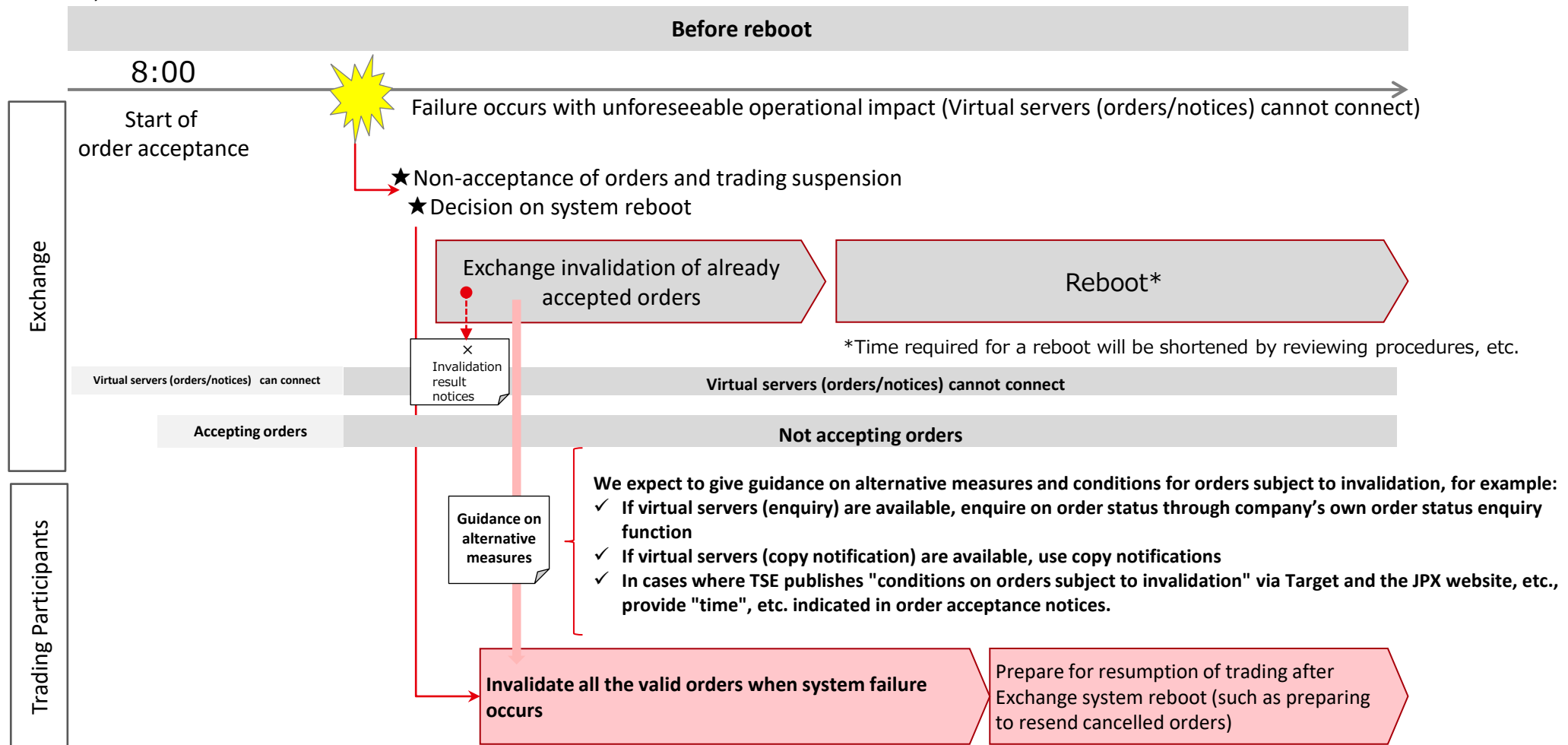
- TSE has summarized and put to a public consultation revisions to the trading rules, as indicated below, to clarify handling, etc. of orders entrusted by customers in cases where the Exchange has no choice but to cancel bids/offers already placed by trading participants due to the impact of a system failure, etc.
- Necessary revisions will be made to clarify that, in the case of cancellation of bids/offers by the Exchange, trading participants in principle should resend orders to the Exchange, but at the same time clarify that a separate arrangement can be made when necessary based on the nature of the entrusted orders or operational needs.

Item	Description	Additional Comments
1. Cancellation of Bids/Offers	<ul style="list-style-type: none"> Clarification that the Exchange may cancel bids/offers from trading participants in the case of a trading suspension due to a system failure, etc. 	<ul style="list-style-type: none"> The current rules provide that the validity of bids/offers in the case of trading suspension will be "specified on a case-by-case basis".
2. Validity of Entrusted Orders	<ul style="list-style-type: none"> Clarification that, as a general rule, orders entrusted by customers with trading participants will remain valid, even after bids/offers from trading participants are cancelled by the Exchange. 	<ul style="list-style-type: none"> The current rules provide that entrusted orders will remain valid even after trading suspensions.
3. Necessity of Resending Entrusted Orders	<ul style="list-style-type: none"> Clarification that, as a general rule, trading participants need to resend orders entrusted by customers, even after bids/offers are cancelled by the Exchange. However, it will also be clarified that if an arrangement has been made in advance between the trading participant and its customer or there is an instruction by the customer, the necessity for trading participants to resend entrusted orders will follow that arrangement or instruction. 	<ul style="list-style-type: none"> If provisions on whether to resend orders, etc. are included in the general conditions of the contract between the trading participant and the customer, this will apply if an arrangement has been made in advance.
4. Other	<ul style="list-style-type: none"> All trading participants will be contacted, through the person(s) responsible for securities trading, for an assessment to understand whether the trading resumption standards have been met, etc. A response to this assessment will be compulsory for all trading participants. 	
5. Implementation Date	<ul style="list-style-type: none"> These rules will be implemented on April 26, 2021. 	

- The following illustrates the response required by trading participants (or Market Information System users) in cases where trading is resumed through a reboot in the event of a system failure that occurs before the start of trading.

(1) In cases where the Exchange cannot return order invalidation result notices

In the event of a system failure, etc. involving an inability to connect with virtual servers (orders/notices), if order invalidation result messages cannot be returned from the Exchange, trading participants will need to invalidate orders using alternative measures, which is illustrated as follows.



(2) Schedule changes

- System events which had occurred after systems came online will occur again after the reboot (with changes such as shortening of the event duration if it is past the event's initially scheduled time).

Example: In the case of a resumption from the afternoon session, the trading period of the morning session will be shortened, and orders will not be accepted.

- Trading participants will need to operate their systems under the revised schedule after receiving a new set of messages related to system events which occur after systems come online.

(3) Handling of sequence numbers after reboot

- To avoid duplication of notice sequence numbers from before and after a reboot, post-reboot notice sequence numbers will be rolled forward*.
- For columns used in messages to the Exchange (order entry sequence number and field for internal processing), values used before the reboot may be used after the reboot (optional). However, for duplication checks, etc. conducted on order entry sequence numbers in trading participant user systems, please note that order acceptance numbers will be "virtual server number + order entry sequence number".

* For specific handling of sequence numbers, please refer to pages 32 and 33.

(4) Responses from the Market Information System

- In the event of a reboot through the Market Information System (MAINS), in order to avoid duplication of sequence numbers, "message sequence numbers" will be rolled forward as before.
- If a failure situation means that clear information of order book before the reboot cannot be disseminated from the Exchange, users will need to clear the order book manually.

If a failure occurs after the start of trading and trading is resumed through a reboot, Execution Completion Notices which have been normally processed by the exchange system and sent to trading participants will, as a general rule, be treated as valid (executions which were processed normally before trading was halted will be considered valid). Below are the main points to note for trading after the restart. These points will be posted on the JPX website, etc. in advance to ensure a wide level of understanding.

(1) Handling of partially executed orders

- Resending the unexecuted part of a partially executed order* will involve a single order entrusted by a customer being split and sent to the Exchange in two installments. As such, it is necessary to consider the link between the customer and the orders.**

*Where the unexecuted part of the order have been cancelled by the Exchange.

**Since, after the system reboot, the field for internal processing and the order entry sequence number (order acceptance number) will become available once again, a link could be established using these data.

- If a trading participant does not resend an order for the unexecuted part of the original order, said trading participant will be required to invalidate the customer order and request the customer to send the order again.

(2) Price continuity and application of regulation

- After a reboot, the base price (i.e., the central price on the order book) and application of regulations will be reset to what they were at the start of morning trading. In consideration of system-based restrictions, etc., the handling will be as follows:

(i) Base price: The last execution price will not be used, and trading will resume with the base price from morning on the day.

(ii) Application of short selling restrictions: Some orders for issues that hit the trigger for short selling restrictions on the day may be returned as errors. However, we will resume trading without applying restrictions such as a trading halt. (For details on short selling restrictions after a resumption, refer to page 34.)

(iii) Trading halt due to corporate information: For an issue for which there has been a media report regarding material information, etc., a trading halt will be implemented even after the trading resumption. (However, if disclosure is made regarding said media report via TDnet by 15 minutes before the trading resumption, a trading halt will not be implemented.)

(3) Handling of market information after the trading resumption

- Open/high/low/close prices, trading volume, trading value, etc. transmitted by FLEX after the resumption will be those from after the resumption. Such information for the whole day (consolidated information before and after the resumption) will be published after the closing of the afternoon session.

- If this information from before the system failure is different from that distributed via FLEX, details of the difference will be published on the JPX website, etc. However, this will not be a condition for trading resumption.

- If a failure occurs after the start of trading, other than the receipt of an Execution Completion Notice through the virtual server, trading participants can confirm execution status using the following methods (1) to (6).

- (1) Company's own order status request function
- (2) Notice Retransmission function
- (3) Drop Copy function
- (4) Data Output to Media (Notices)
- (5) JSCC clearing data
- (6) Execution status list (for an outline of files, refer to the table below.)

→ The list indicated in (6) will be provided by the Exchange in the exceptionally rare case that the impact of a failure means that there is a possibility of discrepancies between the Exchange's and trading participants' understanding of execution status.

- In the rare case a failure does occur that may cause discrepancies between the Exchange's and trading participants' understanding of execution status, the following approaches will apply.

- If Execution Completion Notices are able to be sent to trading participants by the recovery process, trading participants will receive previously unreceived notices via the virtual server.
- If Execution Completion Notices are not able to be sent to trading participants by the recovery process, execution status will be considered as shown on the execution status list for both proprietary and entrusted trading.

- As the situations that can arise from system failures vary widely, in an actual failure situation we will respond flexibly with the measures we consider necessary in our position as a market operator to secure the safety of trading and settlement, regardless of the above framework.

#	Item	Outline
1	File format	- CSV format
2	File creation unit	- Trading participant basis
3	Provided items	- Among the set items for the execution completion notice message, the following items are recorded (the number of bytes and configuration of each item are expected to be the same as for the execution completion notice messages): Exchange Classification Code, Market Classification Code, Participant Code, Source Virtual Server No., Time, Issue Code, Side, Execution Price, Executed Quantity, Field For Internal Processing, Valid Order Quantity, Cross Flag, Price Flag (Execution Identification Flag), Execution Notice Number, Order Acceptance Number
4	Recorded items	- Execution information generated during the time period when the Exchange is likely to have failed to send execution completion notices (the execution status list could be divided into multiple files depending on the number of items of execution information (file size))
5	Provision method	- The execution status list will be provided, via e-mail, to the "contact person(s) in the event of a system failure" who is registered with arrowface (the transmission file could be a password-protected zip file or other formats) - If provision to system vendors is needed, the Exchange foresees that trading participants will need to forward the above e-mail to them. Since the file is provided on a trading participant basis, if trading participants use multiple system vendors, the status list may include execution information generated based on orders via other system vendors.

- When the system failure occurred on October 1, the problem was the inability to disseminate not the quote information, but the basic information that is disseminated beforehand.
- For this reason, we will also clarify alternative measures and recovery plans in MAINS for cases where this basic information cannot be disseminated. Necessary modifications will also be made to the system.

Response Plan for a Stronger Recovery

- Matters to be specified in the connection specifications
 - ✓ Expected recovery plan for cases where FLEX message dissemination will be on an irregular schedule
 - ✓ Specification of data format for publishing issue information, base price information, and multicast group number information by file
 - ✓ That for trading resumption, the recovery of quote information necessary for recreating the order book will take priority, and any corrections to other information (expected to be information such as OHLC prices, trading volume, trading value, VWAP, and index values disseminated by TSE) will be published after the day's market close. The data format for publishing said information will also be specified.
- Matters where responses are required in MAINS (appropriate modifications will be made to the connection specifications)
 - ✓ The day's issue information, base price information, and multicast group number information will be able to be obtained via TCP retransmission even if multicast transmission is not possible.

The treatment of ToSTNeT system in cases where a failure occurs in arrowhead is clarified as follows:

Response
(ToSTNeT)

- TSE will implement the following measures on the system:
 - ✓ Securing of independent network connection to the ToSTNeT system
 - ✓ Linkage of final execution prices, etc. in arrowhead which are used for price checks for ToSTNeT trading
- Even if execution information is not being distributed on a real-time basis on FLEX, ToSTNeT trading will continue and the prices used will be published promptly.
- As priority will be given to continuing safe trading on arrowhead, it is possible that the ToSTNeT system will not be recovered (restarted) by a reboot, etc. In that case, TSE will ensure flexible operation of error correction to ensure that transactions are executed smoothly.

Further
action
after
Council
has closed

- We would like to consider reviewing protocols and connection methods for the next upgraded ToSTNeT system when the system is next upgraded and take measures to further improve the system's resilience.

Plan for Upcoming System Failure Drills (draft)

To ensure the effectiveness of all these policies, we will conduct system failure drills on non-business days: in the first half of FY2021, tests of single functions used for system recovery; and in the second half of FY2021, tests of comprehensive scenarios based around trading resumptions.

	Planned checks (Items to be checked by users)	Scenarios	
		Order Placement	FLEX
H1 FY2021 (Apr. – Sep. 2021)	Checks of single functions used for system recovery <ul style="list-style-type: none"> - Comprehensive check of set values such as reason codes already defined in the connection specifications - Checks of operational procedures in the event of a system failure as indicated in the connection specifications after they are updated -Implementation Schedule <ul style="list-style-type: none"> • Matters not affecting the trading session schedule: provision of multiple events for user connectivity test dates • Matters affecting the trading session schedule: <ul style="list-style-type: none"> Live environment: (i) Jul. 10 and Aug. 15, (ii) Jul. 22 and Sep. 5 Test environment (A): (i) Jun. 10, (ii) Jun. 24 	<ul style="list-style-type: none"> - Error returned: During Temporary Halt - Error returned: No Order Allowed - Orders cancelled (invalidated) by TSE - Start of order acceptance is pushed back by not sending market administration messages on time - Orders not accepted by disconnecting virtual servers before the start of order acceptance etc. 	<ul style="list-style-type: none"> - Basic issue information specially disseminated - Backup/refresh data sent - Recovery for when FLEX message dissemination does not start on time - Provision of files for basic issue information, etc. when multicast transmission is impossible etc.
H2 FY2021 (Oct. 2021- Mar. 2022)	Checks of recovery scenarios <ul style="list-style-type: none"> • Checks of system behavior and operational flow in the event of a system failure before the start of trading using a comprehensive scenario • Checks of functions of TSE systems or user systems that are likely to change 	<ul style="list-style-type: none"> - Orders not accepted by sending market administration messages after order acceptance etc. 	<ul style="list-style-type: none"> - Obtaining basic issue information via TCP when multicast transmission is impossible, etc.
		<ul style="list-style-type: none"> - Resumption of trading through a system reboot - Orders cancelled (invalidated) by TSE (resending orders later as needed) - Drills of the procedure for gathering opinions 	

* Drills based on the same scenario will be conducted multiple times on different dates. (The above (i) and (ii) are planned to be separate scenarios.)

* The test schedule is as currently planned. Details including the schedule and contents of each test will be provided in a test guide.

* In addition to the above, we will also continue to conduct drills based on scenarios which we have been using until now.

TSE System Response Plan

System modifications and operational changes will be made as follows. The connection specifications, etc. will be revised appropriately (the revised specifications will be released around April 2021).

#	Modification summary	Documents to be modified	Test schedule	Implementation/application dates
arrowhead				
1	Specify implementation policy for non-acceptance of orders, trading suspension, etc. and their order of priority	System interface requirements	Sequentially from April 2021	April 2021 (specification in the connection specifications)
2	Specify policy for order invalidation by the Exchange	System interface requirements		
3	Specify recovery process through reboot of Exchange trading system	System interface requirements	H2 FY2021	Around October 2021 - First edition is scheduled to be released in April 2021.
4	Apply connection specifications when Exchange trading system is rebooted (including rolling forward sequence numbers)	Connection specifications (Order/Notice) Connection specifications (Drop Copy) Connection specifications (Query)		
5	Apply provision procedures, file formats, etc. for the execution status list	Connection specifications (Order/Notice)	Sequentially from April 2021 (provision of sample data)	April 2021 (specified in the connection specifications)
MAINS (FLEX)				
6	Specify the following matters in the connection specifications • Recovery procedures for cases where information cannot be disseminated due to a system failure • Notes on recovery through a system reboot by the Exchange	FLEX connection specifications (System Operations)	Sequentially from April 2021	April 2021 (specified in the connection specifications)
7	Improve the TCP transmission function	FLEX connection specifications (TCP)	H2 FY2021	Around October 2021 - First edition is scheduled to be released in April 2021.

Notes: 1) The above plan may be subject to change.

2) Implementation and application dates are for TSE. We presume that trading participants/MAINS users will take actions at appropriate times according to their situations.

3. Clarification of Standards and Procedures for Trading Resumption under Contingency Plan



- The current contingency plan states that TSE will "comprehensively take into account" various factors such as the types of investors and number of securities companies that are unable to participate in trading, in addition to their overall share of trading value.
- For trading resumptions, exchanges need to ensure fair price formation and liquidity based on a certain level of investor diversity and trading volume in the same way as the standards for trading suspensions. Although fair price formation in trading after resumption is ensured through the rules on special quotes and sequential trade quotes, it will have to be sufficiently considered when putting a resumption into practice.
- With this in mind, within the trading suspension/resumption standards, TSE will establish a numerical standard not only for the share of trading value but also for the rate of possible retail participation, which needs particular consideration.

Standards for Trading Suspensions/Resumptions

- Trading will be resumed when the following standards (1) and (2) are met.
 - (1) The share of trading value of trading participants who are able to participate in trading is **approx. more than 50%**.
 - This standard will be established to ensure liquidity in the entire market.
 - (2) The sum of retail orders brokered by trading participants who are able to participate in trading is **approx. more than 30% of trading value by retail investors and the number of trading participants brokering retail orders is 5 or more.**
 - This standard will be established to ensure a certain level of investor diversity and fair price formation.
 - The number of trading participants engaged in brokering retail orders and the share of trading value by retail investors will be determined/calculated based on the surveys on investment trends by investor category.

- As this failure prevented TSE from providing trading opportunities for the whole day, we could not provide the price discovery service that is expected of us as a market operator, and this was a big problem. As such, we need to focus on being able to provide trading opportunities on the same day wherever possible, even if trading conditions are abnormal.
- At the same time, to resume trading, a certain amount of order acceptance time and trading hours need to be secured, so we will enhance transparency and foreseeability of responses by setting standards for these in advance with reference to similar rules from overseas, etc.

Standards for Order Acceptance Time and Trading Hours that Have to be Secured after Recovery

- Order acceptance time: Secure approx. 15 min. for resending orders, correcting orders, etc. after recovery.
 - Trading hours: Resume trading for even a short period of time to provide trading opportunities on the day as far as possible.
- **Resume trading if order acceptance can be resumed by around 14:30 (JST).**
(Example: Order acceptance starts at 14:30 JST and trading resumes at 14:45 JST.)

Notes:

- 1) The above standard is based on a current rule specifying a 15 min. trading suspension to disseminate material facts, and rules in other countries for order acceptance periods (15-20 min.) for trading resumptions.
 - 2) At least 15 min. is expected to be secured for reconnecting systems (including receiving multicast routing maintenance messages and reconnecting virtual servers) before starting order acceptance. After the decision to restart trading, some time will be needed for system recovery and responses to customers, etc., before the start of order acceptance, but as this will vary depending on the status of the failure, etc., we do not plan to specify a standard for how long this should take.
- The extension of trading hours will be separately discussed after the Council has closed.

- In the event of a natural disaster, etc. (a powerful typhoon, the Tokyo Inland Earthquake, etc.), TSE's current rules state that it will "comprehensively consider" various factors including the share of trading value of trading participants that are unable to participate in trading. Unlike a system failure related to exchange markets, we also have to take into account the safety of human lives and the function of the financial market as a whole.
- In order to respond to societal demand for trading and understand the actual situation with regards to damage, information needs to be shared with the relevant authority and related organizations (such as Japan Securities Dealers Association, the Investment Trusts Association, Japan, Japan Investment Advisers Association, Japan Securities Depository Center, Inc., and the Bank of Japan). **As such, in the event of a natural disaster, etc., we will determine trading suspensions/resumptions based on discussions with these parties.**
- In cases such as when a trading suspension is determined before damage is incurred, or a trading resumption is decided when the recovery timeline is still uncertain (cases such as the below), existing frameworks may not be applicable. For this reason, it would be desirable to discuss possible responses, etc. to these cases and clarify industry-wide.

Possible example cases for trading suspensions/resumptions in the event of a natural disaster, etc.

- When, for example, a powerful typhoon is expected to cause significant damage due to overflowing rivers, etc., and we have to determine whether a trading suspension is appropriate before it arrives, this will not be possible based on the numerical standard of the share of trading value. We would need to consider other factors such as expected damage and the overall operation of the financial market.
- When determining trading resumption in the aftermath of a large earthquake, we expect that to avoid investors being unable to sell their shares for a long period of time, the decision will have to be made based on not only the numerical standard of the share of trading value but also discussions with related parties.

- In the event of a system failure, we need to quickly assess whether the trading resumption standards have been met in an effective and highly transparent manner. Thus, TSE will create a framework which specifies in advance the contact persons of each trading participant and receives their reply about the possibility of their participation after trading resumption based on a notice sent by the Exchange with necessary information.

Procedure for Gathering Opinions on Trading Resumptions

(1) Contact persons for opinion gathering

- TSE will gather opinions from **all trading participants** through **persons responsible for securities trading**.

- * The rules will be amended to specify a procedure for gathering opinions through the persons responsible for securities trading.
- * To secure a contact when said persons cannot be reached, we will ask for information on multiple contact persons.
- * In addition, we will check the situations at system vendors and information vendors.

(2) Details on the method for opinion gathering

- After determining when recovery operations can be completed, the Exchange will promptly notify trading participant representatives and persons responsible for securities trading through Target.
- Said notice will describe recovery procedures (necessity of resending orders, connection procedure, etc.), a tentative schedule (time for starting reconnection, etc.), and a response deadline (e.g., respond within 30 min. ahead of a final decision on resumption).

- **Responses are assumed to be registered via Target** as a general rule.

- * If Target is unavailable, we will separately check with persons responsible for securities trading of the top 30 trading participants by share of trading value.
- Trading participants can expect to choose from four responses: (1) Probably can participate within the day, (2) Probably can participate only in wholesale operations within the day, (3) Probably can participate only in retail operations within the day, and (4) No immediate prospects on participation/Unknown.
 - * The above procedure for gathering opinions may not be conducted if trading can be resumed in the event of a system failure by having trading participants reconnect according to the connection procedures as per normal.
 - * This procedure is also expected to be used to allow trading participants to report whether they can participate in the event of a natural disaster, etc.

4. Enhancement of Information Provision



Information Provision Policy in the Event of a System Failure (1)



- To make sure that investors and other market users can access information on details of the system failure and the situation regarding TSE's responses, etc. quickly and appropriately, we have created a dedicated web page on the JPX website and will use it to post this information.
- We have developed rules about the frequency of updates (every 30 minutes as a rule) as well as the information contents, and disseminate information based on these rules.
- Information posted on the JPX website will also be made known to the general public using Twitter, etc.

Item	Description	Notes
1. Location of posted information	<p>(1) JPX website</p> <ul style="list-style-type: none"> - A web page has been launched to enable various stakeholders to access information compiled specific to system failure. It will include information such as whether trading is affected and details of system failure. - If trading is affected as in the case of a trading suspension, an alert for notification will be conspicuously posted on the homepage to bring attention to it. <p>(2) Target</p> <ul style="list-style-type: none"> - If a trading suspension, etc. is needed, notifications will be issued through Target in addition to (1). 	<ul style="list-style-type: none"> - In the event of a failure that does not affect operations, such as when an automatic switchover normally occurs, a notification will not be specially posted on the homepage.
2. Update frequency	<p>(1) JPX website</p> <ul style="list-style-type: none"> - The first notification will be posted immediately after a failure is detected and as soon as possible when the extent of impact, etc. is confirmed. (However, if order acceptance must be suspended immediately, such as in the case of a trading server failure, the first notification will be posted even if confirmation of the failure impact has yet to be fully completed.) - Afterwards, whenever there is new information on the extent of impact or the event summary, etc., the relevant information will be updated. - Even if there is no new information (no developments in the situation), this will be clarified in an update, as a general rule every 30 minutes from the most recent update. <p>(2) Target, email to contact persons in the event of a system failure, Twitter, etc.</p> <ul style="list-style-type: none"> - When the JPX website is updated, notification of an update will also be sent through these tools (push notifications) 	<ul style="list-style-type: none"> - Even if system recovery occurs immediately, a notification will be given that "a system failure occurred but the system is now recovered". - Emails will be sent to the email address of the "contact person(s) in the event of a system failure" registered via arrowface (up to three (3) addresses can be registered.)

Item	Description	Notes
3. Published contents	<ul style="list-style-type: none"> - The following information will be disclosed on the JPX website: <ul style="list-style-type: none"> ✓ Operational status of arrowhead and ToSTNeT system (whether trading is affected or not) ✓ Details of the system failure such as the affected system(s), the extent of impact, and event summary ✓ Updated information in chronological order, etc. - The above disclosure steps are expected to include the following: <ol style="list-style-type: none"> (1) Event detection (system failure) (2) Operational impact (possible event in the future in addition to an event occurring at that time) (3) Possibility of a trading suspension (4) Trading suspension (5) Expected timing of trade resumption (in the case of a trading suspension) (6) When trade resumption is determined, the resumption procedures and schedule (in the case of a trading suspension) (7) Trading schedule on the next business day, etc. 	<ul style="list-style-type: none"> - Information will be promptly disclosed in English after being disclosed in Japanese. - Every effort will be made to provide details or causes of the failure. However, in cases where these are not identifiable immediately, sending information on systems operations, impact on trading and trading recovery will take priority.
4. Information dissemination	<ol style="list-style-type: none"> 1) Target, email to contact person(s) in the event of a system failure <ul style="list-style-type: none"> - Notification will also be issued via Target and email to contact person(s) in the event of a system failure, as before. (2) Twitter, etc. <ul style="list-style-type: none"> - For system failures that could affect trading, information posted on the JPX website needs to be made known to the general public, so Twitter (official JPX account) and other similar platforms will be used to do this. 	
5. Implementation date	<ul style="list-style-type: none"> - For arrowhead, information provision began with a test run together with system failure drills for users on Jan. 23, 2021 and live operations in Feb. 2021. - For the J-GATE derivatives system, information provision will begin in Apr. 2021. 	<ul style="list-style-type: none"> - This policy will be improved as required through system failure response drills, etc.

- This concludes the discussion at the Council.
- We will implement the proposed measures as they are ready. Specifically, action on rules-based measures is underway with some public consultations already finished, among other things, and we will also be acting promptly on system-based measures through speedy revisions of the connection specifications, etc.
- Beginning from now, we will be working with trading participants and other market users to enable the necessary responses for a smooth and effective trading resumption, by checking the processes and verifying the effectiveness of the proposed rules and procedures through system failure drills and other means, and carrying out constant revisions. Through this, we aim to improve the resilience of and restore confidence in the market.

Reference Material



Council Members and Observers

	Name of companies, organizations, etc.
Trading participants	SMBC Nikko Securities Inc.
	SBI SECURITIES CO., Ltd.
	Okasan Securities Co., Ltd.
	Goldman Sachs Japan Co., Ltd.
	Daiwa Securities Co. Ltd.
	Nomura Securities Co., Ltd.
	Meiwa Securities Co., Ltd.
	UBS Securities Japan Co., Ltd.
	Rakuten Securities, Inc.
Institutional investors	Asset Management One Co., Ltd.
	Fidelity Investments (Japan) Limited
Retail investors	Retail investors
Data vendors	QUICK Corp.
	Refinitiv Japan K.K.
System vendors	Japan Information Processing Service Co., Ltd.
	Nomura Research Institute, Ltd.
(Listed in Japanese alphabetical order in each category)	
Observers	The Financial Services Agency of Japan
	The Investment Trusts Association, Japan
	Japan Securities Dealers Association
	Sapporo Securities Exchange
	Nagoya Stock Exchange, Inc.
	Fukuoka Stock Exchange

Note: In the Specialist Working Group for Recurrence Prevention Measures, the above members as well as Societe Generale Securities Japan Limited and Tachibana Securities Co., Ltd. participated as trading participants, and Japan Investment Advisers Association participated as an observer.

Council Topics of Discussion

Meeting		Topics
Council 1st Meeting	Oct. 23	<ol style="list-style-type: none"> 1. Purpose of establishment of Council; Council Members and Observers 2. Details of the incident on October 1 3. Outline of recurrence prevention measures 4. Major topics for discussion
Specialist WG 1st Meeting	Nov. 6	<ol style="list-style-type: none"> 1. Purpose of the Working Group 2. Working Group Members and Observers 3. Meeting schedule and draft agenda
Specialist WG 2nd Meeting	Nov. 20	<ol style="list-style-type: none"> 1. Enhancement of information provision in the event of a system failure 2. Development of rules regarding handling of orders and procedures for trading resumption in the event of a system failure, etc.
Specialist WG 3rd Meeting	Dec. 4	<ol style="list-style-type: none"> 1. Clarification of standards, etc. for trading resumption under the Contingency Plan 2. Development of rules regarding handling of orders and procedures for resuming trading in the event of a system failure, etc. 3. Policy on responses, etc. to inconsistency after the start of trading 4. Responses in the event of a FLEX failure 5. Handling of orders entrusted by customers in the case of order cancellation by the Exchange 6. Draft information provision policy in the event of a system failure
Specialist WG 4th Meeting	Dec. 18	<ol style="list-style-type: none"> 1. Clarification of standards, etc. for trading resumption under the Contingency Plan 2. Development of rules regarding handling of orders and procedures for resuming trading in the event of a system failure, etc. 3. Responses in the event of a FLEX Failure 4. System failure drill program for FY2021 5. Information provision policy in the event of a system failure
Council 2nd Meeting	Dec. 21	<ul style="list-style-type: none"> • Interim Report
Specialist WG 5th Meeting	Jan. 15	<ol style="list-style-type: none"> 1. Schedule for applying amended rules, etc. 2. Development of rules regarding handling of orders and procedures for resuming trading in the event of a system failure, etc. 3. Clarification, etc. of standards for trading resumption under the Contingency Plan
Specialist WG 6th Meeting	Jan. 29	<ul style="list-style-type: none"> • Development of rules regarding handling of orders and procedures for resuming trading in the event of a system failure, etc. (policy on handling of sequence numbers after reboot, etc.)
Specialist WG 7th Meeting	Feb. 12	<ul style="list-style-type: none"> • Development of rules regarding handling of orders and procedures for resuming trading in the event of a system failure, etc. (procedures, etc. for confirmation of execution status)
Specialist WG 8th Meeting	Feb. 26	<ol style="list-style-type: none"> 1. Responses in the JPX derivatives market 2. Draft update to the Contingency Plan
Specialist WG 9th Meeting	Mar. 12	<ul style="list-style-type: none"> • Report from the Council for Recurrence Prevention Measures (draft)
Council 3rd Meeting	Mar. 25	<ul style="list-style-type: none"> • Report from the Council for Recurrence Prevention Measures (draft)

Progress of Recurrence Prevention Measures

- To prevent a similar incident to the failure in arrowhead on Oct. 1, 2020, measures have been implemented when ready.
- Hitherto TSE has operated arrowhead under the slogan of "Never Stop" and emphasized initiatives to improve reliability, but going forward we will focus in the same way on improving resilience, to further ensure that recovery measures are prompt and appropriate.

#	Recurrence Prevention Measures	Contents	Schedule
1	System responses and comprehensive checks	- Correction of NAS switchover setting	Completed: Oct. 5, 2020
		- Comprehensive check of NAS settings	Completed: End of Oct.
		- Development of measures for forced switchover of other hardware	Completed: End of Nov.
		- Switchover tests and drills	Completed: Jan. 23, 2021 (user test) -Further testing is planned on an ongoing basis.
2	Enhancement of procedures for failsafe trading suspensions	- Confirmation of whether there are any past cases of failure to suspend trading	Completed: End of Oct.
		- Development of a function which suspends trading without using NAS	Completed: End of Nov.
3	Development of rules for trading suspensions and resumptions	- Development of rules necessary to resume trading on the same day, clarification of standards for trading suspensions/resumptions, discussion on ideal information provision, and so on	Completed: Interim Report: Dec. 21, 2020 Report: Mar. 25, 2021

The schedule for the various rule amendments is shown in the following table.

	Response	Schedule
1	Enhancement of information provision	<ul style="list-style-type: none"> Feb. 1, 2021: Start of operation Ongoing improvements through system failure drills, etc.
2	Rules for handling of entrusted orders, etc.	<ul style="list-style-type: none"> Jan. 27, 2021: Public consultation (until Feb. 26, 2021) Apr. 26, 2021 (planned): Implementation of rules
3	Amendments to contingency plan	<ul style="list-style-type: none"> Mar. 5, 2021: Public consultation (until Apr. 4, 2021) Apr. 26, 2021 (planned): Implementation of rules
4	Rules on procedures, etc. for cases where Execution Completion Notices cannot be sent	<ul style="list-style-type: none"> End of Mar. 2021: Public consultation (until end of Apr. 2021) Jun. 2021 (planned): Implementation of rules*

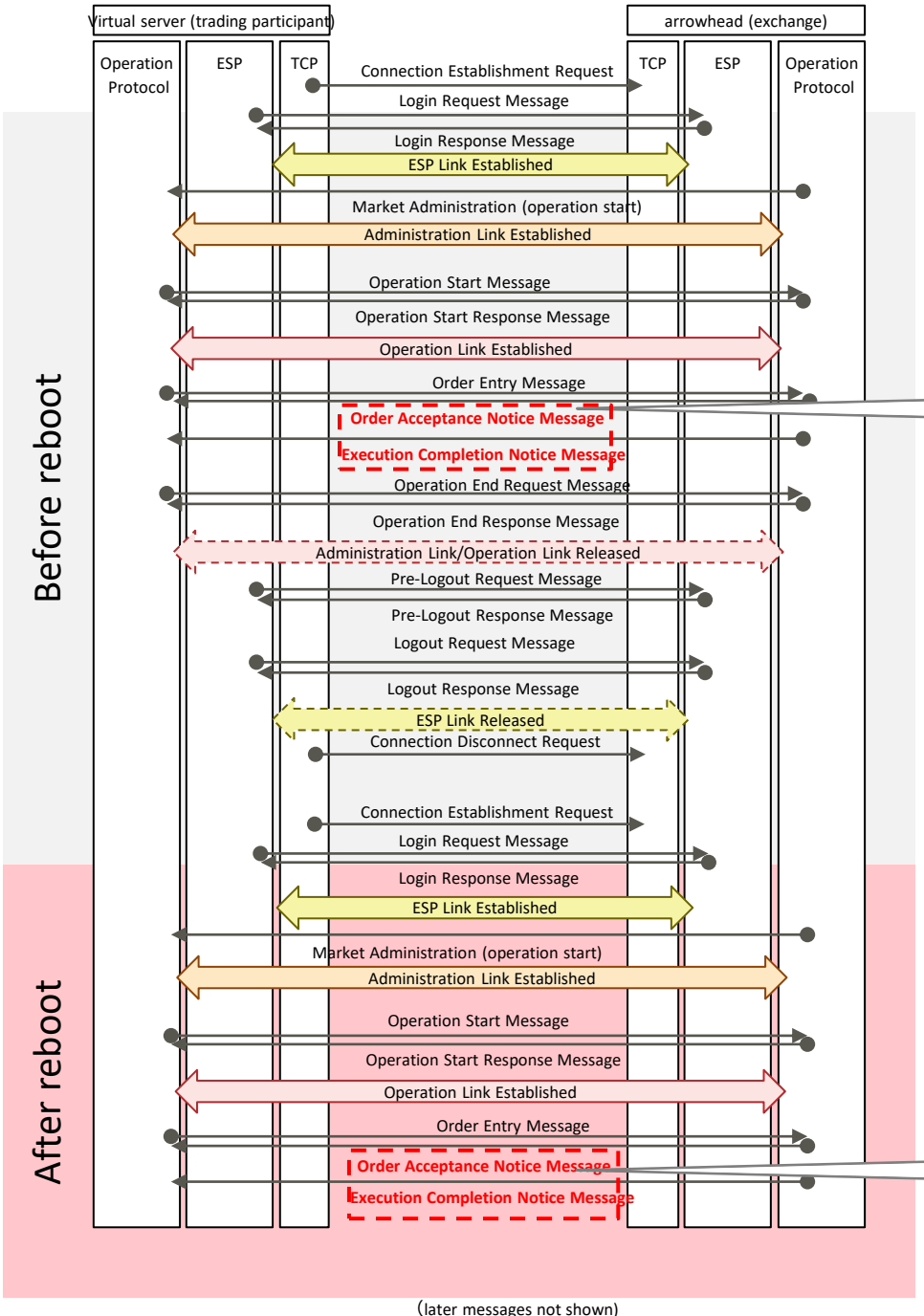
*Although the connection specifications concerning the execution status list will be revised in April, for procedural reasons, the changes to rules will be exercised around June.

Examples of Orders for which Resending May be Inappropriate

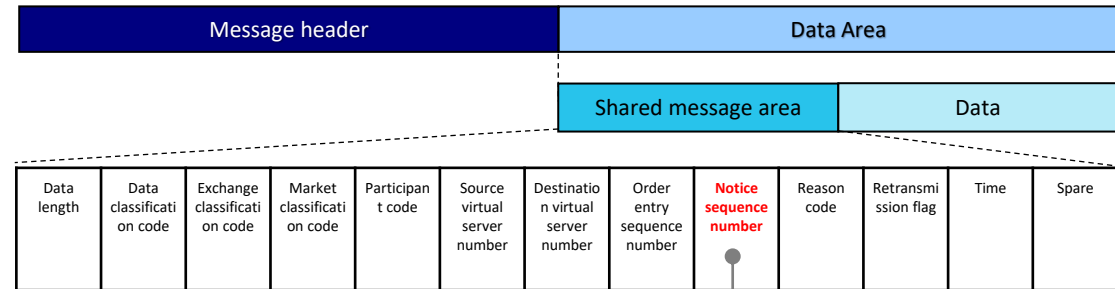
Comments received on whether it is appropriate to resend entrusted orders in the case of order cancellation by the Exchange, and TSE's responses, are as follows:

Order Types	Summary of Comments Received	TSE Response
Orders from Institutional Investors	<ul style="list-style-type: none"> Whether to continue executing all orders will be checked as a business practice. However, predetermined arrangements on handling will be need to be agreed with overseas investors as it is not possible to check with them. 	<ul style="list-style-type: none"> It is possible to check with customers whether to continue executing their orders. On the other hand, it is possible to specify rules for resending orders in advance, including with overseas customers.
DSA Orders	<ul style="list-style-type: none"> It is necessary to check with customers individually whether to execute their orders as per prior instructions at unusual trading hours. (e.g. algorithms that calculate market impact based on a full day of order executions) We would like to remove the need to check with individual customers whether to resend orders. 	<ul style="list-style-type: none"> Some consider that it is necessary to check with customers their intentions, while others do not. It seems to be difficult to come to a consensus.
DMA Orders	<ul style="list-style-type: none"> It is necessary for customers to resend orders or prepare alternative measures. 	<ul style="list-style-type: none"> Does the nature of these orders make it difficult for trading participants to resend such orders?
VWAP Orders	<ul style="list-style-type: none"> It is necessary to check with customers their intentions. 	<ul style="list-style-type: none"> It will be possible i) to check with customers individually or ii) to agree on arrangements with customers in advance.
On-open/on-close Orders	<ul style="list-style-type: none"> It may be necessary to check with customers their intentions based on market conditions. 	<ul style="list-style-type: none"> It will be possible i) to check with customers individually or ii) to clarify with customers in advance that orders will be executed on open/close after trading resumption.

Review of Handling of Sequence Numbers after Reboot (1/2)

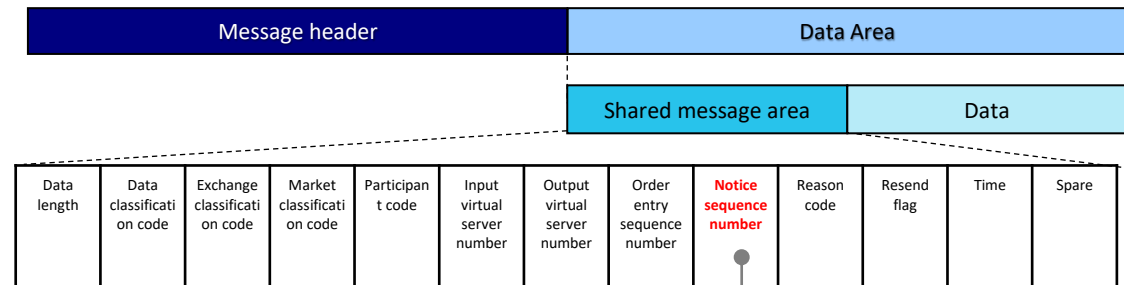


Acceptance/Execution-related Notice Message **before** reboot



Notice messages are given numbers in consecutive sequence per virtual server and per notice type (acceptance/execution). These start with the initial value of 1.

Acceptance/Execution-related Notice Message **after** reboot










Notice messages will be given numbers in consecutive sequence per virtual server and per notice type (acceptance/execution). **Regardless of accepted notice sequence numbers before the reboot, these will start with the initial value of 5000001.**

The sequence of events before the connection is established after the reconnection will be set out in the revised connection specifications. (We will consider as much as possible the need to avoid constraints on trading participant system behavior.)

Review of Handling of Sequence Numbers after Reboot (2/2)

Handling of sequence numbers is as indicated below. Other detailed requirements will later be specified and announced in the connection specifications.

#		Current Set Values (outline)	Revised Set Values (outline)
1	Message sequence number 	<ul style="list-style-type: none"> Sequence numbers used for ESP link control which are assigned to all messages transmitted and received (consecutive unique numbers that increase in increments of 1). Uniqueness is guaranteed within the scope of ESP link. 	No change
2	Order entry sequence number 	<ul style="list-style-type: none"> Set per virtual server, in ascending order (skipped numbers are accepted) for each set of order data The initial value is set to 1 or more. Managed on a day-to-day basis regardless of disconnection or re-connection of virtual servers 	<ul style="list-style-type: none"> Set per virtual server, in ascending order (skipped numbers are accepted) for each set of order data The initial value is set to 1 or more. Managed on a day-to-day basis regardless of disconnection or re-connection of virtual servers <u>(however, in the case that the exchange trading system is rebooted, the uniqueness of the numbers will be guaranteed within each system reboot).</u>
3	Field for internal processing 	<ul style="list-style-type: none"> A unique value is set per participant (via all virtual servers used by said participant) for each exchange, market, and issue. 	<ul style="list-style-type: none"> A unique value is set <u>per participant</u> (via all virtual servers held by said participant) <u>for a whole day for each exchange, market, and issue (however, in the case that the exchange trading system is rebooted, a unique value within each system reboot will be set).</u>
4	Notice sequence number 	<ul style="list-style-type: none"> Consecutive sequence numbers are set for notice messages per virtual server and per notice type (acceptance/execution). These start with the initial value of 1. 	<ul style="list-style-type: none"> Consecutive sequence numbers will be set for notice messages per virtual server and per notice type (acceptance/execution). These start with the initial value of 1. <u>If the exchange trading system is rebooted, the value set for the first notice message after the reboot will be 50000001, regardless of already accepted notice sequence numbers. Consecutive sequence numbers will be set for further notices.</u>
5	Order acceptance number 	<ul style="list-style-type: none"> Issued for each order received from a virtual server and guaranteed to be unique. Comprised of a "virtual server number" and an "order entry sequence number". 	<ul style="list-style-type: none"> Issued for each order received from a virtual server <u>for a whole day</u> and guaranteed to be unique. <u>However, in the case that the exchange trading system is rebooted, the uniqueness of the numbers will be guaranteed within each system reboot.</u> Comprised of a "virtual server number" and an "order entry sequence number".
6	Execution notice number 	<ul style="list-style-type: none"> Set per market/issue and guaranteed to be unique. (Since numbering is conducted for each issue, the numbers are not consecutive per virtual server.) 	<ul style="list-style-type: none"> Set per market/issue <u>for a whole day</u> and guaranteed to be unique. (Since numbering is conducted for each issue, the numbers are not consecutive per virtual server.) <u>In the case of a system reboot, since said numbers will be rolled forward all at once, the uniqueness of an execution notice number will be guaranteed throughout a whole day, regardless of the number of system reboots.</u>
7	Notice creation number per issue 	<ul style="list-style-type: none"> A number whose uniqueness is guaranteed within notices issued based on the same order per market/issue. As the numbers are ascending, it becomes possible to identify the order of issued notices within the same order. 	No change

 Set on the virtual server side  Set on the Exchange trading system

Limitation of Short Selling Restrictions

- A limitation of the short selling restrictions is that if an issue has hit the trigger for short selling price restrictions during trading before a system failure, a reboot will mean that said issue returns to its pre-trigger status.

- Below are points to be noted if an order for such an issue is resent during the order acceptance period after a reboot.

(1) Short selling in a price range above the trigger price

Short selling orders may be accepted regardless of whether they are uptick or downtick

(2) Short selling in a price range at or below the trigger price

Short selling orders will be rejected regardless of whether they are uptick or downtick

⇒ Orders which were accepted before the system failure may be rejected immediately after a reboot.

Specific example:

Where there is no continuous price restriction from the previous day, the base price is JPY 100 (trigger price: JPY 90) and the last price before failure is JPY 88 (uptick trend):

Before system failure

Sell	Buy
:	
<u>100</u>	
99	
:	
91	
90	
89	
88 ↑	
87	
:	

Short 10

Reboot due to system failure

After reboot

Sell	Buy
:	
<u>100</u>	
99	
:	
91	
90	
89	
88	
87	
:	

Behavior at these price ranges is different

Part of



Corresponding to above (1). Any short selling orders in these price ranges may be accepted after the reboot.

Part of

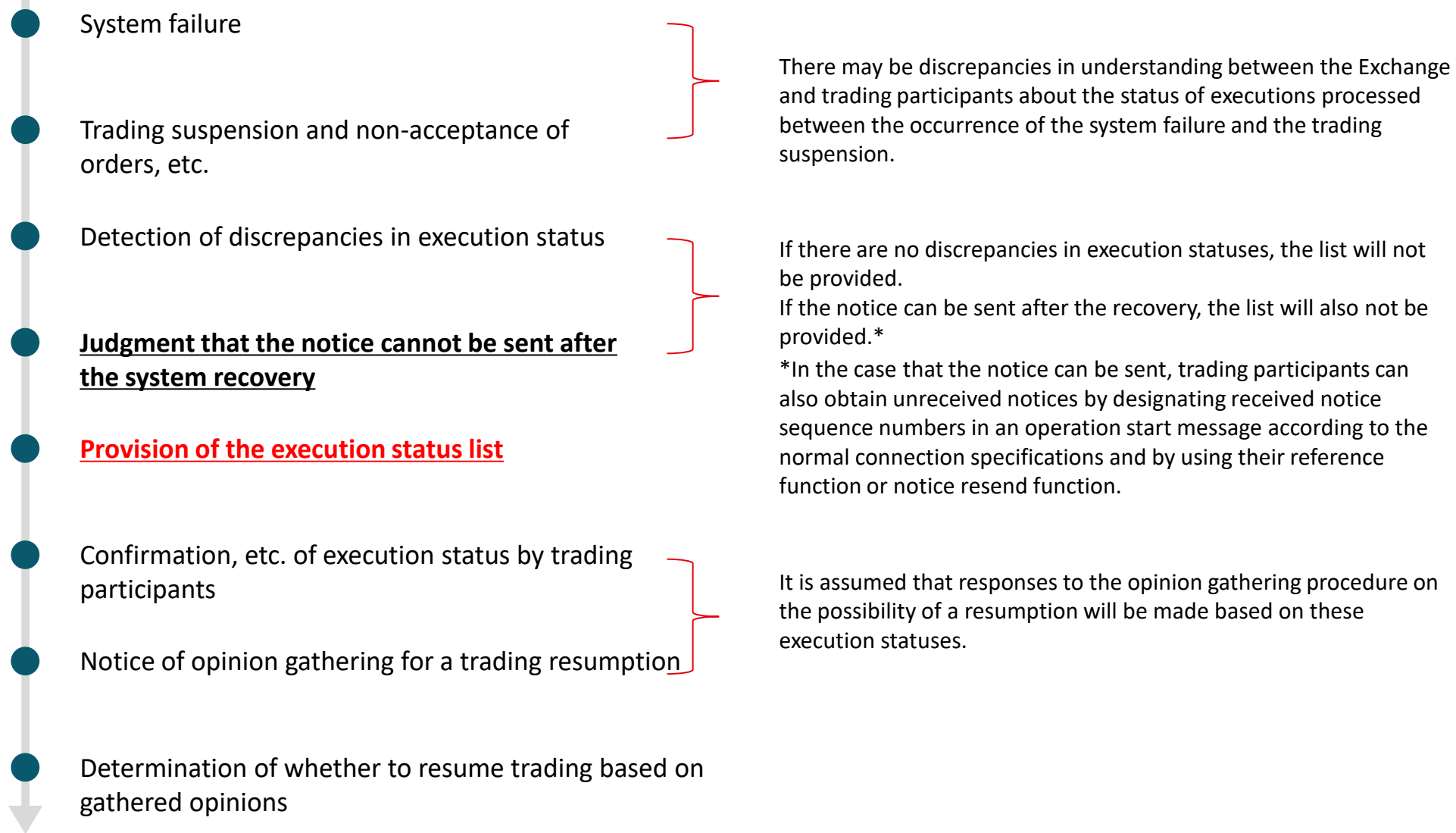


Corresponding to above (2). Any short selling orders in these price ranges will be rejected after the reboot.

Short selling order at JPY 88 (or more): accepted
 Short selling order at JPY 87(or less): rejected
 -The price at which an order is rejected will be determined by whether the order is uptick or downtick

Short selling order at JPY 91 (or more): accepted
 Short selling order at JPY 90 (or less): rejected

- If a failure occurs after the start of trading which may lead to discrepancies in execution status and Execution Completion Notices cannot be sent to trading participants, TSE will provide the execution status list before gathering opinions on and considering a trading resumption.
- The timeline before and after the provision of the execution status list is as follows:



Rules at Selected Overseas Exchanges

	NYSE	LSE	DB	SGX	Euronext	HKEx	TSE (Before)	TSE (After)
Order cancellation	√	√	Partial	√	Partial	√	Partial	√
Methods of notification of order cancellation	√	Partial	√	√	Partial	—	—	√ Set out in the connection specifications, etc.
Time period before resumption of trading (Order acceptance time)	—	At least 20 min.	—	At least 15 min.	—	—	In principle, 30 min. (From internal manuals)	√ At least 15 min. Clarified in the Contingency Plan
Requirements, etc. for trading (market) suspension and resumption of trading	Specific criteria are not published. Decisions seem to be made based on each exchange's internal criteria. (In that case, they may resume trading even though not all trading participants can respond.)						Comprehensive consideration of the share of trading value (generally above 50%), attributes of trading participants, and other factors	√ Overall share of trading value (approx. more than 50%), share of retail investors (approx. more than 30%) and no. of trading participants (approx. 5 or more)
Information provision, etc.	Information is provided in an integrated manner such as via webpages dedicated to system failures.						—	√ - Creation of information provision policy and information provision via a dedicated webpage and social media - Announcement and advancement of system failure drills with market participants

- Compiled based on information available on each exchange's website, etc.

- Criteria are thought to be pre-determined by each exchange and may include not only quantitative criteria, such as share of trading value, but also qualitative criteria, such as attributes of securities companies.