



Consultation paper

# Proposed enhancements to auction routines for the SGX-ST market

15 July 2019

Singapore Exchange

## Responding to this Consultation Paper

On behalf of Singapore Exchange Securities Trading Limited (“**SGX-ST**”), Singapore Exchange Limited (“**SGX**”) invites comments on this consultation paper.

Please send your responses through any of the following means:

Mode	Correspondence Details
Email	rules@sgx.com
Mail	Singapore Exchange Regulation 11 North Buona Vista Drive #06-07, The Metropolis Tower 2 Singapore 138589 (Attention: Regulatory Development & Policy)

Responses should include a summary of the major points, a statement of interest, and reasoned explanations. Please identify the specific policy or rule proposal on which you are commenting. Please also include your full name and, where relevant, the organisation you are representing, as well as your email address or contact number so that we may contact you for clarification. Anonymous responses may be disregarded.

We may make public all or part of any written submission, and may disclose your identity. You may request confidential treatment for any part of the submission that is proprietary, confidential, or commercially sensitive, by clearly marking such information. You may request not to be specifically identified.

We may subject any policy or rule amendment to regulatory concurrence. For this purpose, you should note that notwithstanding any confidentiality request, we may share your response with the relevant regulator.

By sending a response, you are deemed to have consented to the collection, use, and disclosure of personal data that is provided to us for the purpose of this consultation paper or other policy or rule proposals.

We request all comments by **15 August 2019**.

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# I Introduction

## 1 Scope of this consultation paper

- 1.1 SGX seeks public comment on proposed enhancements to the auction routines that takes place at the end of the Opening Routine, Mid-Day Break and Closing Routine<sup>1</sup> (collectively referred to as the “**Auction Routines**”).

## 2 Introduction

- 2.1 SGX reviews its market structure continually to find ways to improve robustness and price discovery, with the objective to enhance trading for our market participants.
- 2.2 Price discovery in an efficient market is one where bids and offers by market participants are exposed to competition from bids and offers of other participants in a reliable and unhindered manner<sup>2</sup>. This allows the price discovery process to take place in an orderly fashion. At the same time, events of sharp price dislocation may undermine the objective of operating an orderly market and reduce investor confidence in the markets.
- 2.3 Market participants are expected to have pre-trade controls in place and they are responsible for ensuring that these are adequate, appropriate and in place whenever they carry out trading.
- 2.4 In addition, to complement market participants’ internal controls, SGX-ST has in place a suite of exchange-level safeguards, including the “Force Key” function<sup>3</sup>, which operates throughout the trading day, and dynamic circuit breakers<sup>4</sup>, which only operate during the continuous trading session.
- 2.5 To further strengthen the suite of exchange-level safeguards, SGX is now considering putting in place new safeguards that operate during the Auction Routines. The key proposals under consideration are outlined below.

## 3 Overview

- 3.1 We reviewed the controls implemented by other securities markets. The controls broadly take the form of one or more of the following:

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<sup>1</sup> The terms “Opening Routine”, “Mid-Day Break”, “Closing Routine” and “Adjust Phase” have the meanings as set out in set out in Regulatory Notice 8.2.1 — Trading Hours, Market Phases, Application of Market Phases and Principles and Rules for Trade Matching of the SGX-ST Rules.

<sup>2</sup> See paragraph 2.8 of the Monetary Authority of Singapore’s Guidelines on Regulation of Markets (Guideline No. SFA 02-G01, dated 1 July 2015).

<sup>3</sup> The force key function requires orders entered at prices outside of certain predetermined price ranges to be confirmed using the Force Key function, before they may be submitted. It is an exchange-level pre-trade check intended to minimise the occurrence of error trades arising from the erroneous entry of order prices. It is intended to complement, and not replace, market participants’ responsibility to adopt adequate and appropriate measures and practices to safeguard against the execution of erroneous trades. See Regulatory Notice 11.4.2(g) – “Application of the Force Key” of the SGX-ST Rules.

<sup>4</sup> The dynamic circuit breakers, which operate during the continuous trading phase only, act as speed bumps which moderate price movements by providing a pause in trading once certain price thresholds are achieved. The risk of wider contagion in the securities market may therefore be averted. See SGX-ST Rule 8.10A.

- (a) Imposing a price collar during auctions<sup>5</sup>;
- (b) Providing a time extension for the auction period if certain conditions are met<sup>6</sup>; or
- (c) Restricting the role of market orders during auctions<sup>7</sup>.

3.2 For the Singapore securities market, SGX is considering imposing a price collar during auctions and/or providing a time extension for the auction period, discussed further below. We also considered limiting the role or use of market orders during auctions. However, we believe that market orders continue to serve a useful function, in particular for market participants who wish to ensure certainty of trade execution at the market price. Hence, we do not propose to limit the role or use of market orders during auctions.

*Implementation of price collars*

3.3 Price collars prevent trades from being executed beyond a certain price range. Orders which could match at prices beyond the price collar do not participate in the relevant auction routine. Specifically, new limit buy orders above the upper price band and limit sell orders below the lower price band will be blocked during the Pre-Open and/or Pre-Close Phase (as may be relevant). Similarly, all resting day orders that are limit buy orders above the upper price band and limit sell orders below the lower price band will be cancelled during the auction. Long-dated orders outside of the preceding price bands will be de-activated and reloaded on the next trading day (if they have not expired).

3.4 It is contemplated that a larger price collar of  $\pm 30\%$  will apply for the Opening Routine as compared to a  $\pm 10\%$  price collar for the Mid-Day Break and Closing Routine<sup>8</sup>. The reference prices for the collars will generally be the last traded price, i.e. the previous day's closing price for the Opening Routine, and the last traded price before the Mid-Day Break and Closing Routine respectively<sup>9</sup>.

3.5 To reduce the likelihood of the price collar unduly restricting price discovery for less actively traded counters, the price collar for the Opening Routine and Mid-Day Break will not be in effect if a counter has not traded for the entire day prior to the routine. For the opening auction, we also propose not to apply the price collar if a counter has not traded for the entire previous Market Day. SGX will also reserve the discretion to lift the price collar in exceptional circumstances, where we deem it appropriate in the interests of operating a fair and orderly market.

*Extension of auction routine*

3.6 An alternative being considered is for an extension of the auction routine by a fixed period should

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<sup>5</sup> For example, price collars are in place for NASDAQ's opening and closing routine (see [https://www.nasdaqtrader.com/content/ProductsServices/Trading/Crosses/openclose\\_faqs.pdf](https://www.nasdaqtrader.com/content/ProductsServices/Trading/Crosses/openclose_faqs.pdf)), as well as in Hong Kong Exchange's ("HKEX") closing routine (see [https://www.hkex.com.hk/Global/Exchange/FAQ/Securities-Market/Trading/CAS?sc\\_lang=en](https://www.hkex.com.hk/Global/Exchange/FAQ/Securities-Market/Trading/CAS?sc_lang=en)).

<sup>6</sup> For example, in the London Stock Exchange, a time extension is activated during an auction routine if the indicative equilibrium price is outside of a certain price range, or if the price results in unexecuted market orders (see page 72 of <https://www.lseg.com/sites/default/files/content/documents/MIT201%20-%20Guide%20to%20the%20Trading%20System%20Issue%2014-9.pdf>).

<sup>7</sup> For example, for HKEX, the upper and lower limit of the equilibrium price set by the opening auction routine is determined by limit orders only (see [https://www.hkex.com.hk/Global/Exchange/FAQ/Securities-Market/Trading/Pre-opening-Session?sc\\_lang=en](https://www.hkex.com.hk/Global/Exchange/FAQ/Securities-Market/Trading/Pre-opening-Session?sc_lang=en)). In another example, the Australia Securities Exchange does not allow market orders to participate in the opening and closing auctions (see [https://www.asx.com.au/services/trading-services/order\\_types.htm](https://www.asx.com.au/services/trading-services/order_types.htm)).

<sup>8</sup> The calibration of price bands is discussed further at paragraphs I18.11 and I18.12.

<sup>9</sup> The setting of reference prices is discussed further at paragraphs I18.9 to I18.10.

the Equilibrium Price<sup>10</sup> move beyond a certain threshold. The contemplated thresholds are  $\pm 30\%$  from the previous day closing price of a counter for the Opening Routine, and  $\pm 10\%$  from the last traded price for the Mid-Day Break and Closing Routine. The extension is proposed to be for 5 minutes<sup>11</sup>. The 5 minute period takes reference from the duration of the cooling-off period that SGX currently has in place when a dynamic circuit breaker<sup>12</sup> is activated. We believe this duration is sufficient for market participants to manage their orders, while not being overly long as to impede the orderly functioning of the market. Market participants will be notified if and when the time extension is activated. Participants can enter, modify or withdraw orders during the extended time, but no order-matching occurs.

- 3.7 While more time will be given to market participants to manage their orders, there will be no restrictions on price discovery (e.g. no price limits). If, at the end of the time extension, the Equilibrium Price matched at the auction is one that is outside the pre-determined price bands, orders will still be matched at that price.

#### *Hybrid model*

- 3.8 SGX is also considering a hybrid model, where time extensions will apply for the Opening Routine and Mid-Day Break, while a price collar will be applied on the Closing Routine. The operation of both mechanisms will be as described above. This is to allow for greater market-led price discovery in the Opening Routine and Mid-Day Break, while ensuring greater price stability in the Closing Routine. This hybrid model will also avoid the need to cancel orders during the course of a trading day, and allows the end time of the Closing Routine to be fixed (as opposed to being possibly extended for some counters if the time extension proposal is adopted).
- 3.9 SGX is seeking feedback and confirmation of whether these enhancements should be implemented, as well as their appropriate form if so.
- 3.10 We discuss the above considerations in greater detail in Part II: “Proposed measures under consideration”.

## **II Proposed measures under consideration**

### **4 Opening Routine**

- 4.1 The Opening Routine takes place from 8.30am to 9.00am and consists of the Pre-Open Phase and Non-Cancel Phase.
- 4.2 During the Pre-Open Phase (which occurs from 8.30am to any time between 8.58am – 8.59am), orders can be entered, modified or withdrawn. The bid (offer) can be higher (lower) than the offer (bid). There will be no matching of orders during this phase. This phase ends randomly at any time between 8.58am – 8.59am.
- 4.3 The Non-Cancel Phase begins simultaneously with the end of the Pre-Open Phase. During the

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<sup>10</sup> “Equilibrium Price” refers to the single price at which orders at the end of the Opening Routine, Mid-Day Break, Closing Routine and Adjust Phase are matched, based on the matching algorithm of SGX-ST, as set out in Regulatory Notice 8.2.1 – “Trading Hours, Market Phases, Application of Market Phases and Principles and Rules for Trade Matching” of the SGX-ST Rules.

<sup>11</sup> The actual time extension may range from 4 – 5 minutes, depending on the timing of the random end at the end of the extended phase.

<sup>12</sup> Dynamic circuit breakers operate during the continuous trading sessions, acting as speed bumps which moderate price movements during trading. See Regulatory Notice 8.14.1 – “Circuit Breaker” of the SGX-ST Rules.

Non-Cancel Phase, there can be no input, amendment or withdrawal of orders. The orders that can be matched are matched at a single price computed based on an algorithm set by SGX-ST. Unmatched orders that are not expired are carried forward into the next trading session, being the continuous trading session in the morning.

#### *Opening Routine: Assessment of Price Collar*

- 4.4 We considered the benefits and challenges of implementing price collars<sup>13</sup> for the Opening Routine.
- 4.5 **Price stability.** Implementing price collars in the Opening Routine will ensure price stability of the affected counter during the opening auction.
- 4.6 **Market-led price discovery curtailed.** Market-led price discovery will be curtailed, as the opening auction price can only be formed within the price collar. This may not be best suited for the Opening Routine, as significant events might have happened overnight that could significantly affect the fair market price of the relevant counter. However, a well-calibrated price collar (i.e. one that is sufficiently wide) may mitigate this concern.
- 4.7 **Certainty of auction end time.** Putting in place price collars in the Opening Routine will ensure that the opening auction ends at a fixed time (as opposed to time extensions, which will cause the auction phase to be extended for 5 minutes).
- 4.8 **Need to cancel/block orders.** In implementing price collars, we had considered allowing orders to be entered at any price, but to prevent any matching of trades if the Equilibrium Price<sup>14</sup> (the “EP”) is a price that falls outside of the price collars. In such a case, the orders in the order book (with the exception of any orders that expire at the end of the Auction Routine) will be brought forward to the next market phase. Where the natural EP (i.e. what the EP would have been but for the existence of price collars) is a price outside of the price collars, the price collars will allow matching of orders only up to the limit of the price band. This may however result in an overflow of orders which would have matched, but for the price band, to be brought over to the continuous trading phase. Such overflow of unmatched buy and sell orders may result in an “overlapped” order book at the start of continuous trading which cannot ordinarily be resolved with the matching logic of the continuous trading session<sup>15</sup>. (See **Appendix A** for an illustration.) Hence, resting orders outside of price bands (specifically, buy orders above the upper price band and sell orders below the lower price band) will be cancelled during the auction. Long-dated orders (or Good-Till-Cancelled (“GTC”) orders) outside of the preceding price bands will be deactivated during the auction and reloaded the next trading day (if it has not expired). Similarly, new limit buy orders above the upper price band and limit sell orders below the lower price band will be blocked during the Pre-Open Phase.
- 4.9 Please see **Appendix B1** for an illustrated example of how the price collar may operate during the Opening Routine.

#### *Opening Routine: Assessment of Price-Triggered Time Extension*

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<sup>13</sup> See paragraphs I3.3 to I3.5 for a brief description of the price collar.

<sup>14</sup> “Equilibrium Price” refers to the single price at which orders at the end of the Opening Routine, Mid-Day Break, Closing Routine and Adjust Phase are matched, based on the matching algorithm of SGX-ST, as set out in Regulatory Notice 8.2.1 — Trading Hours, Market Phases, Application of Market Phases and Principles and Rules for Trade Matching.

<sup>15</sup> In continuous trading, the matching logic contemplates the existence of a resting order and an aggressor order. Where there are overlapping resting orders on both the buy and sell side of the order book, an auction matching logic would generally be required to resolve all the orders.

- 4.10 We further considered the benefits and challenges of implementing price-triggered time extension<sup>16</sup> for the Opening Routine.
- 4.11 **Market-led price discovery not curtailed.** Unlike for price collars, market-led price discovery will not be curtailed. A potentially drastic change in EP will lead to a 5 minutes time-extension for the Pre-Open Phase, allowing market participants to manage their orders. At the end of the extended time, the EP will be determined based on the existing algorithm. This may be more suitable for the Opening Routine, as significant events might have happened overnight that could significantly affect the fair market price of the relevant counter.
- 4.12 **Drastic price change still theoretically possible.** A price-triggered time extension serves to alert market participants and allow them to manage their orders, hence reducing the likelihood of price dislocations which are not reflective of prevailing market conditions for the counter. It would also alert other participants of a potential price dislocation, allowing for additional liquidity to come in. As there are no fixed price collars in place, drastic price change during the opening auction is still possible.
- 4.13 **Potential 5 minutes delay of auction end time.** A price-triggered time extension for the opening auction would mean that the end time of the opening auction may be delayed by 5 minutes for an individual counter (e.g. ending at 9.05am instead of 9.00am). The Continuous Trading phase for such a counter will commence 6 minutes later than usual, e.g. at 9.06am instead of at 9.00am. Other counters that are not triggered for the time extension will continue to commence Continuous Trading at 9.00am.
- 4.14 **No need to cancel/block orders.** As there are no price collars in place, the EP that is determined at the end of the opening auction will be the natural EP. There will not be any “artificially” created imbalance in the order book, hence, there will be no need to cancel/block any orders.
- 4.15 Please see **Appendix B2** for an illustrated example of how the price-triggered time extension may operate during the Opening Routine.
- 4.16 The scope of instrument covered, calibration of price bands and reference price for setting of the price bands are discussed further in Section I18.

**Question 1:**

(a) Do you think SGX should implement one of the above proposed safeguards for the Opening Routine? If yes, do you think the price collar or price-triggered time extension is more appropriate? Please provide reasons for your views.

(b) If your answer above is that SGX should implement the price collar for the Opening Routine, do you agree with the proposal to lift the price collar if a counter has not had a single trade in the preceding trading day? Please provide reasons for your views.

(c) If your answer above is that SGX should implement the price-triggered time extension for the Opening Routine, do you agree that the proposed duration of 5 minutes is sufficient to address price dislocations? Please provide reasons for your views.

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<sup>16</sup> See paragraphs I3.6 and I3.7 for a brief description of the time extension.



## 5 Mid-Day Break

- 5.1 The Mid-Day Break takes place from 12.00pm to 1.00pm (for days with full day trading)<sup>17</sup> and consists of the Pre-Open Phase and Non-Cancel Phase.
- 5.2 As with the Opening Routine, during the Pre-Open Phase (which occurs from 12.00pm to any time between 12.58pm – 12.59pm), orders can be entered, modified or withdrawn. The bid (offer) can be higher (lower) than the offer (bid). There will be no matching of orders during this phase. This phase ends randomly at any time between 12.58pm – 12.59pm.
- 5.3 The Non-Cancel phase begins simultaneously with the end of the Pre-Open Phase. During the Non-Cancel Phase, there can be no input, amendment or withdrawal of orders. The orders that can be matched are matched at a single price computed based on an algorithm set by SGX-ST. Unmatched orders that are not expired are carried forward into the next trading session, being the continuous trading session in the afternoon.

### *Mid-Day Break: Assessment of Price Collar*

- 5.4 We considered the benefits and challenges of implementing price collars for the Mid-Day Break.
- 5.5 **Price stability.** Implementing price collars in the Mid-Day Break will ensure price stability of the affected counter during the mid-day auction.
- 5.6 **Market-led price discovery curtailed.** Market-led price discovery will be curtailed, as the auction price can only be formed within the price collar. However, a well-calibrated price collar (i.e. one that is sufficiently wide) may mitigate this concern.
- 5.7 **Certainty of auction end time.** Putting in place price collars in the Mid-Day Break will ensure that the opening auction ends at a fixed time (as opposed to time extensions, which will cause the auction phase to be extended for 5 minutes).
- 5.8 **Need to cancel/block orders.** For the reasons discussed in paragraph II4.8, in order to implement price collars at the Mid-Day Break, there is a need to de-activate/block orders outside of price bands (specifically, buy orders above the upper price band and sell orders below the lower price band). This includes de-activating long-dated orders<sup>18</sup> and cancelling resting day orders from the continuous trading session in the morning.
- 5.9 Please see **Appendix C1** for an illustrated example of how the price collar may operate during the Mid-Day Break.

### *Mid-Day Break: Assessment of Price-Triggered Time Extension*

- 5.10 We further considered the benefits and challenges of implementing price-triggered time extension for the Mid-Day Break.
- 5.11 **Market-led price discovery not curtailed.** Unlike for price collars, market-led price discovery will not be curtailed.
- 5.12 **Drastic price change still theoretically possible.** A price-triggered time extension serves to alert market participants and allow them to manage their orders, hence reducing the likelihood of price dislocations which are not reflective of prevailing market conditions for the counter. It would also alert other participants of a potential price dislocation, allowing for additional liquidity to come in. As there are no fixed price collars in place, drastic price change during the Mid-Day Break is still

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<sup>17</sup> There is no Mid-Day Routine for days with half-day trading.

<sup>18</sup> Such long-dated orders will be reloaded the next trading day (if it has not expired).

possible.

- 5.13 **Potential 5 minutes delay of auction end time.** A price-triggered time extension for the Mid-Day Break would mean that the end time of the mid-day auction may be delayed by 5 minutes for an individual counter (e.g. ending at 1.05pm instead of 1.00pm). The Continuous Trading Phase in the afternoon session for such a counter will correspondingly commence 6 minutes later than usual. Other counters that are not triggered for the time extension will continue to commence Continuous Trading at 1.00pm.
- 5.14 **No need to cancel/block orders.** As there are no price collars in place, the EP that is determined at the end of the mid-day auction will be the natural EP. There will not be any “artificially” created imbalance in the order book, hence, there will be no need to cancel/block any orders.
- 5.15 Please see **Appendix C2** for an illustrated example of how the price-triggered time extension may operate during the Mid-Day Break.
- 5.16 The scope of instrument covered, calibration of price bands and reference price for setting of the price bands are discussed further in Section I18.

**Question 2:**

(a) Do you think SGX should implement one of the above proposed safeguards for the Mid-Day Break? If yes, do you think the price collar or price-triggered time extension is more appropriate? Please provide reasons for your views.

(b) If your answer above is that SGX should implement the price collar for the Mid-Day Break, do you agree with the proposal to lift the price collar if a counter has not had a single trade in that trading day? Please provide reasons for your views.

(c) If your answer above is that SGX should implement the price-triggered time extension for the Mid-Day Break, do you agree that a proposed duration of 5 minutes is sufficient to address price dislocations? Please provide reasons for your views.

## 6 Closing Routine

- 6.1 The Closing Routine takes place from 5.00pm to 5.06pm (for days with full day trading)<sup>19</sup> and consists of the Pre-Close Phase and Non-Cancel Phase.
- 6.2 During the Pre-Close Phase (which occurs from 5.00pm to any time between 5.04pm – 5.05pm), orders can be entered, modified or withdrawn. The bid (offer) can be higher (lower) than the offer (bid). There will be no matching of orders during this phase. This phase ends randomly at any time between 5.04pm – 5.05pm.
- 6.3 The Non-Cancel Phase begins simultaneously with the end of the Pre-Close Phase. During the Non-Cancel Phase, there can be no input, amendment or withdrawal of orders. The orders that can be matched are matched at a single price computed based on an algorithm set by SGX-ST. Unmatched orders that are not expired are carried forward into the next trading session, being the Trade-at-Close Phase.

*Closing Routine: Assessment of Price Collar*

<sup>19</sup> For days with half-day trading, the Closing Routine takes place from 12.00pm to 12.06pm.

- 6.4 We considered the benefits and challenges of implementing price collars for the Closing Routine.
- 6.5 **Price stability.** Implementing price collars in the Closing Routine will ensure price stability of the affected counter during the closing auction.
- 6.6 **Market-led price discovery curtailed.** Market-led price discovery will be curtailed, as the auction price can only be formed within the price collar. However, a well-calibrated price collar (i.e. one that is sufficiently wide) may mitigate this concern. In addition, there would have been a full day of trading prior to the Closing Routine, allowing the market ample opportunity to react to any events throughout the trading day. Hence, it is less likely for there to be sharp price movements in the Closing Routine (as compared to during the Opening Routine).
- 6.7 **Certainty of auction end time.** Putting in place price collars in the Closing Routine will ensure that the closing auction ends at a fixed time (as opposed to time extensions, which will cause the auction phase to be extended for 5 minutes).
- 6.8 **Need to cancel/block orders.** New limit buy orders above the upper price band and limit sell orders below the lower price band will be blocked during the Pre-Close Phase. Similarly, all resting orders that are limit buy orders above the upper price band and limit sell orders below the lower price band will be de-activated during the closing auction. This includes de-activating long-dated orders<sup>20</sup> and cancelling resting day orders from the continuous trading session in the afternoon. As with the current framework, the Trade-at-Close phase following the closing auction will continue to use the closing auction price.
- 6.9 Please see **Appendix D1** for an illustrated example of how the price collar may operate during the Closing Routine.

*Closing Routine: Assessment of Price-Triggered Time Extension*

- 6.10 We further considered the benefits and challenges of implementing price-triggered time extension for the Closing Routine.
- 6.11 **Market-led price discovery not curtailed.** Unlike for price collars, market-led price discovery will not be curtailed.
- 6.12 **Drastic price change still theoretically possible.** A price-triggered time extension serves to alert market participants and allow them to manage their orders, hence reducing the likelihood of price dislocations which are not reflective of prevailing market conditions for the counter. It would also alert other participants of a potential price dislocation, allowing for additional liquidity to come in. As there are no fixed price collars in place, drastic price change during the closing auction is still possible.
- 6.13 **Potential 5 minutes delay of auction end time.** A price-triggered time extension for the Closing Routine would mean that the end time of the closing auction may be delayed by 5 minutes for an individual counter. The Trade-at-Close Phase thereafter will correspondingly commence later than usual, which will necessarily cut short the duration of the Trade-at-Close Phase (e.g. from 10 minutes to 5 minutes). In addition, other counters that are not triggered for the time extension will continue to have the closing auction end at 5.06pm. This means that the time at which a closing price is made available will differ between counters. This may in turn have an impact on market participants' downstream systems and processes, as well as on index providers or fund managers who may use the closing price to determine the price of a derivative instrument or fund.
- 6.14 **No need to cancel/block orders.** As there are no price collars in place, the EP that is determined

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<sup>20</sup> Such long-dated orders that have not expired will be reloaded the next trading day.

at the end of the closing auction will be the natural EP. There will not be any “artificially” created imbalance in the order book, hence, there will be no need to cancel/block any orders.

- 6.15 Please see **Appendix D2** for an illustrated example of how the price-triggered time extension may operate during the Closing Routine.
- 6.16 The scope of instrument covered, calibration of price bands and reference price for setting of the price bands are discussed further in Section II8.

**Question 3:**

(a) Do you think SGX should implement one of the above proposed safeguards for the Closing Routine? If yes, do you think the price collar or price-triggered time extension is more appropriate? Please provide reasons for your views.

(b) If your answer above is that SGX should implement the price collar for the Closing Routine, do you agree with the proposal to lift the price collar if a counter has not had a single trade in that trading day? Please provide reasons for your views.

(c) If your answer above is that SGX should implement the price-triggered time extension for the Closing Routine, do you agree that the proposed duration of 5 minutes is sufficient to address price dislocations? Please provide reasons for your views.

## **7 Hybrid Model**

- 7.1 We are also considering a hybrid model, where time extensions will apply for the Opening Routine and Mid-Day Break, while a price collar will be applied on the Closing Routine. The operation of both mechanisms will be similar to what is described in the relevant sections above.
- 7.2 We believe the price-triggered time extensions for the Opening Routine and Mid-Day Break may be more appropriate as it places emphasis on market-led price discovery, while at the same time alerting market participants of possible imbalance in the order book and allowing time for market participants react. In particular, for the Opening Routine, the last good trade (which would likely be the last trade of the previous Market Day) would have occurred some time ago and intervening events might have significantly affected the market price of the security. In addition, applying the price-triggered time extensions avoids the need to cancel (or de-activate) resting orders that are brought over from the preceding trading phase or block new incoming orders that are outside the price bands.
- 7.3 We believe that a price collar is appropriate for the Closing Routine, as it provides certainty as to the time when a closing auction price will be made available. We understand that this certainty on time is important for the downstream systems and processes of market participants, as well as for index providers or fund managers who use the closing price to determine the price of a derivative instrument or fund. A price collar will also ensure greater stability for the closing price of a counter, which is generally regarded as being more systematically important than the opening auction or mid-day auction price.

**Question 4:**

(a) Do you think the hybrid model described above is suitable for Singapore’s securities market? Please provide reasons for your views.

(b) Do you think implementing the hybrid model will bring about significant operational or technical concerns? If yes, please elaborate on the potential operational or technical concerns.

## 8 Scope of instruments covered, reference price and calibration of price bands

8.1 This section discusses the proposed scope of instruments covered, reference price and calibration of price bands, that is applicable for the price-triggered time extension and price collar discussed in above sections (referred to herein as the “**Volatility Controls**”).

### *Scope of instruments covered*

8.2 SGX proposes to apply the Volatility Controls to the following (collectively defined as “**Relevant Instruments**”):

- (a) all Straits Times Index (“**STI**”) and MSCI Singapore Index (“**SiMSCI**”) component stocks/units;
- (b) all other stocks/units, stapled securities, funds, ETFs and ETNs with a first reference price (discussed below) at or exceeding 0.50 in the underlying currency;

8.3 The first reference price for determining whether a counter falls within the coverage of the Volatility Control as mentioned in paragraph I18.2(b) above for the Opening Routine is determined as follows:

- (a) (i) in the case of a Prescribed Instrument, the closing price of the Prescribed Instrument on the previous Market Day<sup>21</sup>, and (ii) in the case of any other security, the last traded price as at the end of the previous Market Day, or
- (b) where a share consolidation or share split has occurred since the price stated in (a), a price derived from a pricing model established by SGX-ST (for example, the last traded price prior to the effective date of the consolidation, adjusted for the consolidation ratio).

8.4 The first reference price for determining whether a counter falls within the coverage of the Volatility Control for the Mid-Day Break and Closing Routine is the first traded price for that Market Day. If there is no trade in that Market Day, the first reference price will be as set out in paragraphs I18.3(a) or I18.3(b) above<sup>22</sup>.

8.5 The list of Relevant Instruments will be updated on a daily basis. For the Mid-Day Break and Closing Routine, if an instrument’s first reference price is above 0.50, even if the traded price falls below 0.50 in the course of the day, it will be subject to the Volatility Control for the rest of the trading day (i.e. if an instrument falls within the scope of the Volatility Control during the Mid-Day Break, it will also be within its scope during the Closing Routine). Conversely, for the Mid-Day Break and Closing Routine, if an instrument’s first reference price is below 0.50, the Volatility Control will not apply to the counter for the rest of the trading day, even if the reference price rises above 0.50 in the course of the day.

8.6 The scope of instruments proposed are largely aligned with that of dynamic circuit breakers, which we assess to be appropriate. The impact of non-index securities trading below \$0.50 on the

<sup>21</sup> Currently, ETFs are the only Prescribed Instrument. Information on how the closing price of a Prescribed Instrument is determined is set out in Regulatory Notice 8.3 — “Closing Price of Prescribed Instrument” of the SGX-ST Rules.

<sup>22</sup> Note that our proposal is to lift the price collar for the Mid-Day Break and Closing Routine if there are no trades done throughout the Market Day, and to lift it for the Opening Routine if there are no trades done throughout the previous Market Day. See paragraph I3.5.

value of the overall market is not significant and poses low contagion risk to the wider market. Extending the coverage to securities trading below \$0.50 may unnecessarily impede price discovery and/or cause undue disruptions to trading. Furthermore, as the dynamic circuit breakers have been in operation on SGX-ST since February 2014, we believe market participants have gained familiarity with the scope of coverage.

- 8.7 The Volatility Control will not apply to the first day of trading in a new listing<sup>23</sup>. As the first reference price for the Opening Routine will generally be the last traded price of the previous Market Day, it would not be feasible to apply the Volatility Control to a new listing. In addition, imposing the Volatility Control on the first day may impede the price discovery process unnecessarily.
- 8.8 The Volatility Control will also not apply to a counter after a trading halt or suspension. As the last traded price of such a counter may have been some time ago, and intervening events during the trading halt or suspension may have a material impact on the price of the counter, imposing the Volatility Control on such counters may impede the price discovery process unnecessarily.

#### *Reference price*

- 8.9 The reference price (for determining the price bands for the Volatility Control) for the Opening Routine is determined as follows:
- (a) (i) in the case of a Prescribed Instrument, the closing price of the Prescribed Instrument on the previous Market Day<sup>24</sup>, and (ii) in the case of any other security, the last traded price as at the end of the previous Market Day, or
  - (b) where a share consolidation or share split has occurred since the price stated in (a), a price derived from a pricing model established by SGX-ST (for example, the last traded price prior to the effective date of the consolidation, adjusted for the consolidation ratio).
- 8.10 The reference price (for determining the price bands for the Volatility Control) for the Mid-Day Break and Closing Routine is the last traded price earlier in the same Market Day. If there is no trade in that Market Day, the first reference price will be as set out in paragraphs I18.9(a) or I18.9(b) above<sup>25</sup>.

#### *Calibration of price collar/price band for triggering extension*

- 8.11 SGX is considering implementing a price collar/price band of  $\pm 30\%$  from the reference price for the Volatility Control Proposal during the Opening Routine, and  $\pm 10\%$  from the reference price for the Volatility Control Proposal for the Mid-Day Break and Closing Routine.
- 8.12 The threshold of  $\pm 10\%$  for the Volatility Control Proposal for the Mid-Day Break and Closing Routine takes reference from the current price bands for the dynamic circuit breaker<sup>26</sup>. We believe this threshold remains appropriate for addressing unusual price movements, without being unduly disruptive to trading.

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<sup>23</sup> A “new listing” here refers to an instrument that is newly listed, regardless of whether it is subject to an initial public offering or placed out. It will also include stocks/units that are created by distribution of dividends in-specie.

<sup>24</sup> Currently, ETFs are the only Prescribed Instrument. Information on how the closing price of a Prescribed Instrument is determined is set out in Regulatory Notice 8.3 — “Closing Price of Prescribed Instrument” of the SGX-ST Rules.

<sup>25</sup> Note that our proposal is to lift the price collar for the Mid-Day Break and Closing Routine if there are no trades done throughout the Market Day. See paragraph I3.5.

<sup>26</sup> See paragraph 4.1 of Practice Note 8.10A – Circuit Breaker of the SGX-ST Rules.

- 8.13 The wider threshold of  $\pm 30\%$  for the Opening Routine is proposed so as to be less restrictive for price discovery, taking into account that the last good trade (which would likely be the last trade of the previous Market Day) would have occurred some time ago and intervening events might have affected the market price of the security. This threshold also takes reference from other markets in the region, which similarly have in place price bands of  $\pm 30\%$ <sup>27</sup>.

**Question 5:**

- (a) Do you agree with the scope of instruments covered, as described in paragraphs I18.2 to I18.8? Please provide reasons for your views.
- (b) Do you agree with how the reference price (for determining the price bands for the Volatility Controls) is determined, as described in paragraphs I18.9 and I18.10? Please provide reasons for your views.
- (c) Do you agree with the calibration of the price bands as described in paragraphs I18.11 to I18.13? Please provide reasons for your views.

## 9 Treatment of linked instruments

- 9.1 SGX is seeking market participants' views on the treatment of linked instruments (e.g. company warrant on a specific underlying security) when a Volatility Control has been activated on the underlying.

### *Single-counter derivative instruments*

- 9.2 Single-counter derivative instruments here refer to any derivative instrument that is derived from a single underlying security, that is not on its own covered by scope of the Volatility Control<sup>28</sup>. Examples include company warrants, structured warrants that are derived from one security and daily leveraged certificates ("**DLCs**") derived from one security.
- 9.3 We propose that if a price-triggered time extension has been activated for an underlying security, the same time-extension will be automatically activated on the relevant single-counter derivative instrument. This is to align the relevant price discovery phase for both the underlying security and the single-counter derivative instrument. Below is an illustration:

**Illustration:** The Auction Extension Phase has been triggered for Company Share A during the Opening Routine. The Opening Routine will therefore be extended by 5 minutes, and the continuous trading phase will be correspondingly pushed back. Similarly, an Auction Extension Phase will be simultaneously activated for the company warrants on Company Share A.

- 9.4 We do not propose to impose separate price collars on single-counter derivative instruments, as such instrument will have its own separate order book.

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<sup>27</sup> For example, for the Korea Exchange and the Stock Exchange of Thailand, the daily price limit is  $\pm 30\%$  from the previous day's closing price. In addition, the Tokyo Stock Exchange sets the daily price limit based on absolute yen, which differs according to the base reference price (which is usually the previous day's closing price). The figures approximate to  $\pm 30\%$  from the previous day's closing price.

<sup>28</sup> The scope of instruments covered is discussed in paragraph I18.2 above.



### *Multi-counter derivative instruments*

- 9.5 Multi-counter derivative instruments here refer to any derivative instrument that is derived from a basket of underlying securities, that is not on its own covered by the scope of the Volatility Control<sup>29</sup>. Examples include structured warrants and DLCs that are derived from indices.
- 9.6 We propose that if a Volatility Control measure has been activated for an underlying security which is a component of the multi-counter derivative instrument, the same measure will **not** be automatically activated on the relevant multi-counter derivative instrument. SGX-ST will however have the discretion to activate the same Volatility Control measure on the multi-counter derivative instrument if it deems appropriate.
- 9.7 The trading of a single security may not significantly impact the price of a multi-counter derivative instrument. Hence, we do not think it is appropriate to automatically activate the same Volatility Control measure on such derivative.

### *Dual currency counters and different board lot sizes on same underlying*

- 9.8 Dual currency counters on the same underlying instrument will be subject to independent Volatility Controls. This is because the two counters are traded separately in two different order books. Further, the independent activation of Volatility Controls for these counters is necessary as the divergence between counters may arise out of differing views on currency movements.
- 9.9 Related counters of different board lot sizes on the same underlying, such as Singtel and Singtel 10, will similarly be subject to independent Volatility Controls. Such counters are traded separately in different order books and generally trade very closely together, hence it is not necessary for the Volatility Controls to be coordinated.

#### **Question 6:**

Do you agree with the proposed treatment of the various types of linked instruments when a Volatility Control has been activated on the underlying, as described in this Section? Please provide reasons for your views.

## **10 Scope of markets covered**

- 10.1 SGX has considered the application of Volatility Controls in respect of its ready market and unit share market.
- 10.2 Volatility Controls are proposed to be implemented only in the ready market, where the vast majority of trades are executed.
- 10.3 For the unit share market, SGX is of the view that Volatility Controls should not apply as it has a much smaller pool of liquidity and is unlikely to have a significant impact on the ready market. There are also mechanical restrictions in place which prevent orders of quantity greater than the lot size defined in the ready market i.e. more than 99 units/shares from being placed in the order book. SGX is of the view that this will reduce the likelihood of disorderliness.
- 10.4 In the same vein, we do not propose to apply the Volatility Controls to direct business trades. This approach is aligned with that of the dynamic circuit breakers.

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<sup>29</sup> The scope of instruments covered is discussed in paragraph 118.2 above.



**Question 7:**

Do you agree with the proposed market coverage of the Volatility Control? Please provide reasons for your views.

**11 Implementation**

- 11.1 SGX will consider the feedback received from market participants and inform market participants of the planned implementation schedule when appropriate.

**Question 8:**

We understand that implementing any of the proposed safeguards may likely require systems/operational changes. If your preferred proposal (as indicated in your responses to the questions above) is to be implemented, what do you think is a practicable timeframe for implementation?

## Appendix A – Example of an “overlapped” order book because of a price collar in the Opening Routine

### Assumptions

- 1) Closing price of the previous trading day: \$10.00
- 2) Price collar: 30%
- 3) Upper limit of price collar:  $(1+30\%) * \$10.00 = \$13.00$
- 4) Lower limit of price collar:  $(1-30\%) * \$10.00 = \$7.00$
- 5) Tick size: \$0.01

### Order book before matching of orders in the Opening Routine

Table 1 shows the order book before the matching of orders in the Opening Routine.

**Table 1**

Bid Volume	Price	Ask Volume	Cumulative Bid Volume (a)	Cumulative Ask Volume (b)	Tradable Volume	Imbalance (a)-(b)	Pressure
80	13.04	20	80	250	80	-170	Sell
30	13.03	40	110	230	110	-120	Sell
70	13.02	30	180	190	180	-10	Sell
100	13.01	80	280	160	160	120	Buy
<b>50</b>	<b>13.00</b>	<b>40</b>	<b>330</b>	<b>80</b>	<b>80</b>	<b>250</b>	<b>Buy</b>
0	12.99	20	330	40	40	290	Buy
0	12.98	20	330	20	20	310	Buy

### Equilibrium price with a price collar

With a price collar, the equilibrium price is the price that has the largest tradable volume within the price collar (i.e. between \$7.00 and \$13.00 inclusive). In this example, this equilibrium price is \$13.00, and the tradable volume is 80 (see highlighted row in Table 1). This will be the opening price at the start of continuous trading in the morning trading session.

### How do orders match with a price collar?

Orders match according to price-time priority.

In terms of the bids, bids with the highest price (\$13.04) have the highest priority. The volume that these bids match is 80.

In terms of the asks, asks with the lowest price (\$12.98) have the highest priority. The volume that these asks match is 20. Asks with the next lowest price (\$12.99 with a volume of 20) are next in priority, followed by asks with the next lowest price after that (\$13.00 with a volume of 40).

### Order book after matching of orders in the Opening Routine

Table 2 shows the order book after the matching of orders in the Opening Routine.

Because of the price collar, the opening price of \$13.00 results in an “overlapped” order book when continuous trading begins in the morning trading session. For prices between \$13.01 to \$13.03 inclusive, there are bids and asks with tradable volume between them (see highlighted cells in Table 2). Such

“overlapped” order book cannot ordinarily be resolved with the matching logic of the continuous trading session<sup>30</sup>.

**Table 2**

Bid Volume	Price	Ask Volume	Cumulative Bid Volume (a)	Cumulative Ask Volume (b)	Tradable Volume	Imbalance (a)-(b)	Pressure
0	13.04	20	0	170	0	-170	Sell
30	<b>13.03</b>	40	30	150	<b>30</b>	-120	Sell
70	<b>13.02</b>	30	100	110	<b>100</b>	-10	Sell
100	<b>13.01</b>	80	200	80	<b>80</b>	120	Buy
50	13.00	0	250	0	0	250	Buy
0	12.99	0	250	0	0	250	Buy
0	12.98	0	250	0	0	250	Buy

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<sup>30</sup> In continuous trading, the matching logic contemplates the existence of a resting order and an aggressor order. Where there are overlapping resting orders on both the buy and sell side of the order book, an auction matching logic would generally be required to resolve all the orders.

## Appendix B1 – Example of how a price collar may operate during the Opening Routine

### Assumptions

- 1) Closing price of the previous trading day: \$10.00
- 2) Price collar: 30%
- 3) Upper limit of price collar:  $(1+30\%) * \$10.00 = \$13.00$
- 4) Lower limit of price collar:  $(1-30\%) * \$10.00 = \$7.00$
- 5) Tick size: \$0.01

### Order book before matching of orders in the Opening Routine

Table 1 shows the order book before the matching of orders in the Opening Routine.

**Table 1**

Bid Volume	Price	Ask Volume	Cumulative Bid Volume (a)	Cumulative Ask Volume (b)	Tradable Volume	Imbalance (a)-(b)	Pressure
80	13.04	20	80	250	80	-170	Sell
30	13.03	40	110	230	110	-120	Sell
70	13.02	30	180	190	180	-10	Sell
100	13.01	80	280	160	160	120	Buy
50	13.00	40	330	80	80	250	Buy
0	12.99	20	330	40	40	290	Buy
0	12.98	20	330	20	20	310	Buy

### Equilibrium price with a price collar

With a price collar, during the Pre-Open Phase of the Opening Routine, participants may not enter (i) new bids higher than the upper limit of the price collar and (ii) new asks lower than the lower limit of the price collar.

In addition, for day limit orders already present in the order book, SGX will cancel (i) bids higher than the upper limit of the price collar and (ii) asks lower than the lower limit of the price collar.<sup>31</sup>

In this example, SGX will cancel the bids priced from \$13.01 to \$13.04 inclusive.

### Order book after cancellation of bids priced above the upper limit of the price collar but before matching of orders in the Opening Routine

Table 2 shows the order book after the cancellation of bids priced above the upper limit of the price collar but before the matching of orders in the Opening Routine.

<sup>31</sup> In the case of orders with an expiry beyond the current trading day (e.g. Good-Till-Cancelled orders), SGX will deactivate these orders and re-enter them at the start of the next trading day.

**Table 2**

Bid Volume	Price	Ask Volume	Cumulative Bid Volume (a)	Cumulative Ask Volume (b)	Tradable Volume	Imbalance (a)-(b)	Pressure
0	13.04	20	0	250	0	-250	Sell
0	13.03	40	0	230	0	-230	Sell
0	13.02	30	0	190	0	-190	Sell
0	13.01	80	0	160	0	-160	Sell
<b>50</b>	<b>13.00</b>	<b>40</b>	<b>50</b>	<b>80</b>	<b>50</b>	<b>-30</b>	<b>Sell</b>
0	12.99	20	50	40	40	10	Buy
0	12.98	20	50	20	20	30	Buy

Equilibrium price with a price collar

With a price collar, the equilibrium price is the price that has the largest tradable volume within the price collar (i.e. between \$7.00 and \$13.00 inclusive). In this example, this equilibrium price is \$13.00, and the tradable volume is 50 (see highlighted row in Table 2). This will be the opening price at the start of continuous trading in the morning trading session.

How do orders match with a price collar?

Orders match according to price-time priority.

In terms of the bids, bids with the highest price (\$13.00) have the highest priority. The volume that these bids match is 50.

In terms of the asks, asks with the lowest price (\$12.98) have the highest priority. The volume that these asks match is 20. Asks with the next lowest price (\$12.99 with a volume of 20) are next in priority, followed by asks with the next lowest price after that (\$13.00 with a volume of 10).

Order book after matching of orders in the Opening Routine

Table 3 shows the order book after the matching of orders in the Opening Routine. This will be the state of the order book when continuous trading begins in the morning trading session.

**Table 3**

Bid Volume	Price	Ask Volume	Cumulative Bid Volume (a)	Cumulative Ask Volume (b)	Tradable Volume	Imbalance (a)-(b)	Pressure
0	13.04	20	0	200	0	-200	Sell
0	13.03	40	0	180	0	-180	Sell
0	13.02	30	0	140	0	-140	Sell
0	13.01	80	0	110	0	-110	Sell
0	13.00	30	0	30	0	-30	Sell

## Appendix B2 – Example of how a price-triggered price extension may operate during the Opening Routine

### Assumptions

- 1) Closing price at the end of the previous trading day: \$10.00
- 2) Price band: 30%
- 3) Upper limit of price band:  $(1+30\%) * \$10.00 = \$13.00$
- 4) Lower limit of price band:  $(1-30\%) * \$10.00 = \$7.00$
- 5) Tick size: \$0.01

### Order book before the matching of orders in the Opening Routine

Table 1 shows the order book before the matching of orders in the Opening Routine.

**Table 1**

Bid Volume	Price	Ask Volume	Cumulative Bid Volume (a)	Cumulative Ask Volume (b)	Tradable Volume	Imbalance (a)-(b)	Pressure
80	13.04	20	80	250	80	-170	Sell
30	13.03	40	110	230	110	-120	Sell
<b>70</b>	<b>13.02</b>	<b>30</b>	<b>180</b>	<b>190</b>	<b>180</b>	<b>-10</b>	<b>Sell</b>
100	13.01	80	280	160	160	120	Buy
50	13.00	40	330	80	80	250	Buy
0	12.99	20	330	40	40	290	Buy
0	12.98	20	330	20	20	310	Buy

### IEP at the end of the Pre-Open Phase of the Opening Routine

SGX will determine the IEP at end of the Pre-Open Phase of the Opening Routine. This end of the Pre-Open Phase will be at any random time between 8:58am and 8:59am.

The IEP is the price that has the largest tradable volume. In this example, the IEP is \$13.02, and the tradable volume at 180 (see highlighted row in Table 1).

SGX will then determine if the IEP at the end of the Pre-Open Phase is within the lower and upper limits of the price band or not (i.e. between \$7.00 and \$13.00). In this example, the IEP is not within the lower and upper limits of the price band.

### Pre-Open Phase to extend by five minutes as the IEP is not within the lower and upper limits of the price band

As the IEP is not within the lower and upper limits of the price band, SGX will extend the Pre-Open Phase of the Opening Routine by five minutes by entering a new Auction Extension Phase.

Similar to as practiced in the Pre-Open Phase, SGX will determine the new IEP at the end of the Auction Extension Phase. The end of the Auction Extension Phase will now be at any random time between 9:04am and 9:05am.

The new IEP is the price that has the largest tradable volume. Regardless of whether the new IEP is within the lower and upper limits of the price band or not, this new IEP will be the opening price at the start of continuous trading in the morning trading session.

In this example, if we assume further that there are no further changes to the order book shown in Table 1 at the end of the Auction Extension Phase, the opening price at the start of continuous trading in the morning trading session is \$13.02.

## Appendix C1 – Example of how a price collar may operate during the Mid-Day Break

### Assumptions

- 1) Last traded price in the morning trading session: \$20.00
- 2) Price collar: 10%
- 3) Upper limit of price collar:  $(1+10\%) * \$20.00 = \$22.00$
- 4) Lower limit of price collar:  $(1-10\%) * \$20.00 = \$18.00$
- 5) Tick size: \$0.01

### Order book before matching of orders in the Mid-Day Break

Table 1 shows the order book before the matching of orders in the Mid-Day Break.

**Table 1**

Bid Volume	Price	Ask Volume	Cumulative Bid Volume (a)	Cumulative Ask Volume (b)	Tradable Volume	Imbalance (a)-(b)	Pressure
80	22.04	20	80	250	80	-170	Sell
30	22.03	40	110	230	110	-120	Sell
70	22.02	30	180	190	180	-10	Sell
100	22.01	80	280	160	160	120	Buy
50	22.00	40	330	80	80	250	Buy
0	21.99	20	330	40	40	290	Buy
0	21.98	20	330	20	20	310	Buy

### Equilibrium price with a price collar

With a price collar, during the Pre-Open Phase of the Mid-Day Break, participants may not enter (i) new bids higher than the upper limit of the price collar and (ii) new asks lower than the lower limit of the price collar.

In addition, for day limit orders already present in the order book, SGX will cancel (i) bids higher than the upper limit of the price collar and (ii) asks lower than the lower limit of the price collar.<sup>32</sup>

In this example, SGX will cancel the bids priced from \$22.01 to \$22.04 inclusive.

### Order book after cancellation of bids priced above the upper limit of the price collar but before matching of orders in the Mid-Day Break

Table 2 shows the order book after the cancellation of bids priced above the upper limit of the price collar but before the matching of orders in the Mid-Day Break.

<sup>32</sup> In the case of orders with an expiry beyond the current trading day (e.g. Good-Till-Cancelled orders), SGX will deactivate these orders and re-enter them at the start of the next trading day.



**Table 2**

Bid Volume	Price	Ask Volume	Cumulative Bid Volume (a)	Cumulative Ask Volume (b)	Tradable Volume	Imbalance (a)-(b)	Pressure
0	22.04	20	0	250	0	-250	Sell
0	22.03	40	0	230	0	-230	Sell
0	22.02	30	0	190	0	-190	Sell
0	22.01	80	0	160	0	-160	Sell
<b>50</b>	<b>22.00</b>	<b>40</b>	<b>50</b>	<b>80</b>	<b>50</b>	<b>-30</b>	<b>Sell</b>
0	21.99	20	50	40	40	10	Buy
0	21.98	20	50	20	20	30	Buy

Equilibrium price with a price collar

With a price collar, the equilibrium price is the price that has the largest tradable volume within the price collar (i.e. between \$18.00 and \$22.00 inclusive). In this example, this equilibrium price is \$22.00, and the tradable volume is 50 (see highlighted row in Table 2). This will be the opening price at the start of continuous trading in the afternoon trading session.

How do orders match with a price collar?

Orders match according to price-time priority.

In terms of the bids, bids with the highest price (\$22.00) have the highest priority. The volume that these bids match is 50.

In terms of the asks, asks with the lowest price (\$21.98) have the highest priority. The volume that these asks match is 20. Asks with the next lowest price (\$21.99 with a volume of 20) are next in priority, followed by asks with the next lowest price after that (\$22.00 with a volume of 10).

Order book after matching of orders in the Mid-Day Break

Table 3 shows the order book after the matching of orders in the Mid-Day Break. This will be the state of the order book when continuous trading begins in the afternoon trading session.

**Table 3**

Bid Volume	Price	Ask Volume	Cumulative Bid Volume (a)	Cumulative Ask Volume (b)	Tradable Volume	Imbalance (a)-(b)	Pressure
0	22.04	20	0	200	0	-200	Sell
0	22.03	40	0	180	0	-180	Sell
0	22.02	30	0	140	0	-140	Sell
0	22.01	80	0	110	0	-110	Sell
0	22.00	30	0	30	0	-30	Sell

## Appendix C2 – Example of how a price-triggered price extension may operate during the Mid-Day Break

### Assumptions

- 1) Last traded price in the morning trading session: \$20.00
- 2) Price band: 10%
- 3) Upper limit of price band:  $(1+10\%) * \$20.00 = \$22.00$
- 4) Lower limit of price band:  $(1-10\%) * \$20.00 = \$18.00$
- 5) Tick size: \$0.01

### Order book before the matching of orders in the Mid-Day Break

Table 1 shows the order book before the matching of orders in the Mid-Day Break.

**Table 1**

Bid Volume	Price	Ask Volume	Cumulative Bid Volume (a)	Cumulative Ask Volume (b)	Tradable Volume	Imbalance (a)-(b)	Pressure
80	22.04	20	80	250	80	-170	Sell
30	22.03	40	110	230	110	-120	Sell
<b>70</b>	<b>22.02</b>	<b>30</b>	<b>180</b>	<b>190</b>	<b>180</b>	<b>-10</b>	<b>Sell</b>
100	22.01	80	280	160	160	120	Buy
50	22.00	40	330	80	80	250	Buy
0	21.99	20	330	40	40	290	Buy
0	21.98	20	330	20	20	310	Buy

### IEP at the end of the Pre-Open Phase of the Mid-Day Break

SGX will determine the IEP at end of the Pre-Open Phase of the Mid-Day Break. This end of the Pre-Open Phase will be at any random time between 12:58pm and 12:59pm.

The IEP is the price that has the largest tradable volume. In this example, the IEP is \$22.02, and the tradable volume at 180 (see highlighted row in Table 1).

SGX will then determine if the IEP at the end of the Pre-Open Phase is within the lower and upper limits of the price band or not (i.e. between \$18.00 and \$22.00). In this example, the IEP is not within the lower and upper limits of the price band.

### Pre-Open Phase to extend by five minutes as the IEP is not within the lower and upper limits of the price band

As the IEP is not within the lower and upper limits of the price band, SGX will extend the Pre-Open Phase of the Mid-Day Break by five minutes by entering a new Auction Extension Phase.

Similar to as practiced in the Pre-Open Phase, SGX will determine the new IEP at the end of the Auction Extension Phase. The end of the Auction Extension Phase will now be at any random time between 1:04pm and 1:05pm.

The new IEP is the price that has the largest tradable volume. Regardless of whether the new IEP is within the lower and upper limits of the price band or not, this new IEP will be the opening price at the start of continuous trading in the afternoon trading session.

In this example, if we assume further that there are no further changes to the order book shown in Table 1 at the end of the Auction Extension Phase, the opening price at the start of continuous trading in the afternoon trading session is \$22.02.

## Appendix D1 – Example of how a price collar may operate during the Closing Routine

### Assumptions

- 1) Last traded price in the afternoon trading session: \$30.00
- 2) Price collar: 10%
- 3) Upper limit of price collar:  $(1+10\%) * \$30.00 = \$33.00$
- 4) Lower limit of price collar:  $(1-10\%) * \$30.00 = \$27.00$
- 5) Tick size: \$0.01

### Order book before matching of orders in the Closing Routine

Table 1 shows the order book before the matching of orders in the Closing Routine.

**Table 1**

Bid Volume	Price	Ask Volume	Cumulative Bid Volume (a)	Cumulative Ask Volume (b)	Tradable Volume	Imbalance (a)-(b)	Pressure
80	33.04	20	80	250	80	-170	Sell
30	33.03	40	110	230	110	-120	Sell
70	33.02	30	180	190	180	-10	Sell
100	33.01	80	280	160	160	120	Buy
50	33.00	40	330	80	80	250	Buy
0	32.99	20	330	40	40	290	Buy
0	32.98	20	330	20	20	310	Buy

### Equilibrium price with a price collar

With a price collar, during the Pre-Close Phase of the Closing Routine, participants may not enter (i) new bids higher than the upper limit of the price collar and (ii) new asks lower than the lower limit of the price collar.

In addition, for day limit orders already present in the order book, SGX will cancel (i) bids higher than the upper limit of the price collar and (ii) asks lower than the lower limit of the price collar.<sup>33</sup>

In this example, SGX will cancel the bids priced from \$33.01 to \$33.04 inclusive.

### Order book after cancellation of bids priced above the upper limit of the price collar but before matching of orders in the Closing Routine

Table 2 shows the order book after the cancellation of bids priced above the upper limit of the price collar but before the matching of orders in the Closing Routine.

<sup>33</sup> In the case of orders with an expiry beyond the current trading day (e.g. Good-Till-Cancelled orders), SGX will deactivate these orders and re-enter them at the start of the next trading day.

**Table 2**

Bid Volume	Price	Ask Volume	Cumulative Bid Volume (a)	Cumulative Ask Volume (b)	Tradable Volume	Imbalance (a)-(b)	Pressure
0	33.04	20	0	250	0	-250	Sell
0	33.03	40	0	230	0	-230	Sell
0	33.02	30	0	190	0	-190	Sell
0	33.01	80	0	160	0	-160	Sell
<b>50</b>	<b>33.00</b>	<b>40</b>	<b>50</b>	<b>80</b>	<b>50</b>	<b>-30</b>	<b>Sell</b>
0	32.99	20	50	40	40	10	Buy
0	32.98	20	50	20	20	30	Buy

How do orders match with a price collar?

Orders match according to price-time priority.

In terms of the bids, bids with the highest price (\$33.00) have the highest priority. The volume that these bids match is 50.

In terms of the asks, asks with the lowest price (\$32.98) have the highest priority. The volume that these asks match is 20. Asks with the next lowest price (\$32.99 with a volume of 20) are next in priority, followed by asks with the next lowest price after that (\$33.00 with a volume of 10).

Order book after matching of orders in the Closing Routine

Table 3 shows the order book after the matching of orders in the Closing Routine. This will be the state of the order book when the Trade at Close Phase begins.

**Table 3**

Bid Volume	Price	Ask Volume	Cumulative Bid Volume (a)	Cumulative Ask Volume (b)	Tradable Volume	Imbalance (a)-(b)	Pressure
0	33.04	20	0	200	0	-200	Sell
0	33.03	40	0	180	0	-180	Sell
0	33.02	30	0	140	0	-140	Sell
0	33.01	80	0	110	0	-110	Sell
0	33.00	30	0	30	0	-30	Sell

## Appendix D2 – Example of how a price-triggered price extension may operate during the Closing Routine

### Assumptions

- 1) Last traded price in the afternoon trading session: \$30.00
- 2) Price band: 10%
- 3) Upper limit of price band:  $(1+10\%) * \$30.00 = \$33.00$
- 4) Lower limit of price band:  $(1-10\%) * \$30.00 = \$27.00$
- 5) Tick size: \$0.01

### Order book before the matching of orders in the Closing Routine

Table 1 shows the order book before the matching of orders in the Closing Routine.

**Table 1**

Bid Volume	Price	Ask Volume	Cumulative Bid Volume (a)	Cumulative Ask Volume (b)	Tradable Volume	Imbalance (a)-(b)	Pressure
80	33.04	20	80	250	80	-170	Sell
30	33.03	40	110	230	110	-120	Sell
<b>70</b>	<b>33.02</b>	<b>30</b>	<b>180</b>	<b>190</b>	<b>180</b>	<b>-10</b>	<b>Sell</b>
100	33.01	80	280	160	160	120	Buy
50	33.00	40	330	80	80	250	Buy
0	32.99	20	330	40	40	290	Buy
0	32.98	20	330	20	20	310	Buy

### IEP at the end of the Pre-Close Phase of the Closing Routine

SGX will determine the IEP at end of the Pre-Close Phase of the Closing Routine. This end of the Pre-Close Phase will be at any random time between 5:04pm and 5:05pm.

The IEP is the price that has the largest tradable volume. In this example, the IEP is \$33.02, and the tradable volume at 180 (see highlighted row in Table 1).

SGX will then determine if the IEP at the end of the Pre-Open Phase is within the lower and upper limits of the price band or not (i.e. between \$27.00 and \$33.00). In this example, the IEP is not within the lower and upper limits of the price band.

### Pre-Close Phase to extend by five minutes as the IEP is not within the lower and upper limits of the price band

As the IEP is not within the lower and upper limits of the price band, SGX will extend the Pre-Close Phase of the Closing Routine by five minutes by entering a new Auction Extension Phase.

Similar to as practiced in the Pre-Close Phase, SGX will determine the new IEP at the end of the Auction Extension Phase. The end of the Auction Extension Phase will now be at any random time between 5:10pm and 5:11pm.

The new IEP is the price that has the largest tradable volume. Regardless of whether the new IEP is within the lower and upper limits of the price band or not, this new IEP will be the closing price for the trading day.

In this example, if we assume further that there are no further changes to the order book shown in Table 1 at the end of the Auction Extension Phase, the closing price for the trading day is \$33.02.

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