INTERNATIONAL SECURITIES EXCHANGE

Matching Engine Opening

Business Requirements

Product Management Group

Confidential

Version: 1.14

Issue Date: March 17, 2015~~January 13, 2015~~

Print Date: March 17, 2015~~April 9, 2014~~

Produced by:

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About This Document

This document specifies the business requirements for functional changes to ISE's opening algorithm.

Document Audience

The audience for this document includes:

- Product Management
- Development
- Software Quality Management
- Technology Member Services
- Market Operations
- Business Development
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Revision History

The following table provides document revision history.

Issue	Date	Change	Author
0.1	2/12/13	Initial write	J. Dowd
0.2	2/28/13	Updates from 1st review session Merged separate rules for new open algo and variation for inverted markets and included Process flow.	J. Dowd
0.3	03/18/13	Updates from review with Eric. Modified algo for order selection/protection step. Added algo for inverted market opening process.	J. Dowd
0.4	03/21/13	Adjusted to use simplified method of handling inverted market, use PMM boundary.	J. Dowd
0.5	03/22/13	Updates after review with KR.	J. Dowd K. Rathi
0.6	03/28/13	Updated Market Order handling.	K. Rathi
1.0	04/01/13	Updated handling of multiple flash auctions in section 3.5. Updated Inverted Market handling. Updated Complex Instrument opening. Updated parameter and configuration sections. Additional examples in Appendix. Added future considerations in Chapter 5.	J. Dowd
1.1	04/09/13	Adjusted tick worse behavior section 3.5.7 Updated following sections: 3.4.6, Iterative Opening Process 3.5.2.1, Determine the Boundary Price Interval 3.5.2.3, Determination of Final Open Price 3.8, Reference Data~~Reference Data~~ 3.9, Market Data	J. Dowd
1.2	04/26/13	Updated tick worse behavior when opening price is within the opening quote, and moved to its own section: 3.5.7. Also updated when opening price is outside the opening quote to also include "At" the opening quote BBO. Noted weighted average will not be used and can be removed. As well as added other configs to be decommissioned. Sections 3.5.8 and 3.5.9. Updated using best CMM quote for boundary and uncrossing behavior sections 3.2.1 and 3.5.2.1.	J. Dowd
1.3	04/29/13	Added future considerations inChapter 5, and restructured formatting. Clarified 3 –tick lock behavior section 3.4.6. Removed concept of using ABBO when there is no boundary price, (i.e. MMs curtail) and moved to future considerations (Chapter 5). As well updated the following affected sections: 3.4.6. Iterative Opening Process 3.5.1.1. Determining the Boundary Price Interval 3.5.2.2 and 3.5.2.3. Determining preliminary open price and final open price	J. Dowd
1.4	05/02/13	Updated Flowchart section **3.4.6~~3.4.6~~** to include flash when oderbook is not crossed, and include 3 tick lock when orderbook is not crossed. Updated 3.5.2.1 when boundary is CMM on both sides and is crossed.	J. Dowd
1.5	12/23/13	3.4.1 and 3.4.3, Clarification on use of non-customer flash. 3.5.2.1, Added Process Flow for boundary price determination. 3.5.2.4, Clarification for non-customer general allocation. 3.5.2.5Clarification on order protection of ISO related orders. Also	J. Dowd

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		Clarification on non-customer unsolicited cancel behavior. 3.5.3.4, Clarification non-customers cancelled vs. booked during order protection and removal. 3.5.7, Clarified terminology of boundary to potential opening quote. Also added process flow for tick worse behavior. 3.7, Clarification, opening algorithm not independent for simple and complex instruments. 5.5, Added future enhancement for more equitable allocation.	
1.5a	1/6/14	3.2.2 Clarify legacy accumulated quantity function. 3.5.1.1. Suggest mentioning OpeningMMMin param here 3.5.1.2-3.5.1.4. Clarification of the accumulated quantity function in the new opening, and other clarifications.	B. Hallnan
1.5b/c	1/21/14	Various sections updated for handling non-customer orders. 3.4.5 Concept of 4th iteration for non-customers and 3 tick protection. And Process flow diagram update. 3.5, Added inverted step, prior to starting first iteration. 3.5.2.1, Noted use of configuration for number of CMMs for boundary price determination openingMMMin setting. And Process flow diagram update. 3.5.2.4 Correction on allocation setting reference. 3.5.3.1 Clarification on concept of wider boundary price. And Process flow diagram update. 3.5.2.2 Modified AQF, to use valid orders and quotes. 3.5.5 Updated Inverted Market Handling. 3.5.4 Added process flow diagram for Iteration 3. 3.8 Clarification on default configuration settings.	J. Dowd
1.6	2/14/14	Added 3.6, Major Steps in the Opening Rotation. Moved portions of AQF discussion to Appendix A. Added Jon's updated examples to Appendix B. Merged other small content changes across version. Built doc in new template.	B. Hallnan
1.7	2/24/14	Updated process flow for iterative opening. Minor updates to appendix example 7. Clarification to 3-tick non-customer behavior, cancel vs. lock behavior. Update to EP handling for inverted concept, protection s/b at the end of last iteration. Updated behavior for use of "No Boundary" concept, updated example 4 & 5 in the appendix.	J. Dowd
1.8	03/04/14	Minor updates to example 4 following section 3 and example 2 following section 3.5.3.5 Clarification when same side of ISE and ABBO boundary is equal reference sections 3.5.2.1 and 3.5.3.1 Clarification on Cust and Cust Prof behavior if/when flash config and away market handling config are set differently than current production. Added example for max value tick worse case section 3.5.7.2 Clarified Configuration tables controlling allocation section **Error! Reference source not found.**~~3.7.1~~ Added OPG only orders section 3.4.4 Appendix example 1, minor update regarding valid interest.	J. Dowd

		Clarification 3-tick and Market Order Lock section 3.4.3 Process flow update for handling "No ISE Bid" and determining boundary price determination, section 3.4.6	
1.9	3/26/14	V1.8 was an unofficial publication. Skipped to 1.9 for clean updated version.	J. Dowd
1.10	4/1/14	Clarification on market order handling section 3.4.3 Clarification Opening Only orders section 3.4.4 Added clarity on random allocation 3.4.5 Clarification on complex opening section 3.7 Clarification on configuration for ABBO protection – non-customer do NOT get ABBO protection and Priority Customer and Customer Professional DO get protection section 3.4.6 Adjusted when 3-tick is/is not triggered section 3.4.6 Re-structured and added clarity on concept of iterative process 3.4.6 Clarification iteration 2 boundary section 3.5.3.1 Missing 4th iteration section 3.6 Clarification of Reserve Order Handling section 3.6.2 Added future enhancement for non-customer protection 5.6 Appendix example 7 clarification Appendix B	J. Dowd
1.11	4/30/14	Clarification market orders handling when there's no acting PMM section 3.4.3 Update iterative opening flow chart Figure 1 section 3.4.6 Update Imbalance when only MM Qtes and crossed prices section 3.5.2.1 Clarification market order handling during inverted markets section 3.5.6.3	J. Dowd
1.12	06/20/14	3.5.3.5 Example 3 minor update 3.5.2.4 Clarification on allocation treatment for Customer Professional 3.5.2.5 Clarification on handling partially locked/released orders during the open	J. Dowd
1.13	10/02/14	3.4.1 Clarification on DNR handling	J. Dowd
1.14	11/11/14	2.4 & 3.8 updates to support separate combo opening from simple instrument opening.	J. Dowd M. DiBenedetto

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Chapter 1 Introduction

This chapter provides an introduction to the Opening BRD.

1.1 Background

Today's opening algorithm does not factor in the away market when the exchange initiates the opening of the market. Among the improvements to the opening process, the system will consider the ABBO when determining the price(s) at which the open will take place.

1.2 Scope

The high level scope of this requirement is to provide functional changes to the opening algorithm.

1.3 Planned Benefits

Proposed changes facilitate added quality to the opening process.

1.4 Delivery Requirements

Requested delivery is R9.0.

1.5 Key Definitions, Acronyms, and Abbreviations

Acronym	Details
ROM	Rapid Opening Mechanism
AMB Lock	Away Market Better Lock
Opening State	The instrument state *Opening* indicates that the market place for the instrument is in the process of opening. This means that no matching of placed orders and quotes is occurring for the instrument and MOps, the Acting PMM or the Matching Engine can initiate the opening rotation.
Imbalance State	Imbalance is a business condition whereby the marketable quantity of a Buy (Sell) order is greater than the quantity of an opposing marketable Sell (Buy) order or the calculated opening price is outside the boundary prices. The instrument state *Imbalance* indicates that an opening rotation was attempted and has failed due to an order book imbalance.
Boundary Price Interval	A price range between buy side price(s) and sell side price(s), determined by a weighted average calculation method and/or determined by valid PMM quotes, and/or the ABBO. The boundary price interval ensures that ISE does not open too far from realistic market prices for a security.
Preliminary Opening Price	A price at which an algorithm determines the maximum number of contracts that can be traded.
Accumulated Quantity	At each price, the total quantity of all executable regular market and limit orders, calculated separately for buy and sell sides.
Allocation	Matching orders using a defined method to prioritize them, specifying the sequence in which the orders will match and the quantities of each that will trade.
Pro Rata	An allocation method that splits the available quantity of a single order or quote on one side with multiple orders on the opposite side; the opposite side orders each get a share proportionate to the ratio of their order quantity to the total quantity of all the opposite side orders at the price.
Price Time	An allocation method that splits the available quantity of orders or quotes at the same price in order of received time, oldest first.
Tick Worse	"Tick worse" refers to the process whereby a market maker's quote is automatically adjusted by decreasing the bid price or increasing the ask price. This process is initiated whenever a quote side is fully matched, and is conducted in accordance with tick worse parameters that have been set by the market maker.
Contingent Orders	Contingent orders are AON and MEQ orders, hidden quantities of Reserve Orders, and triggered stop orders.
Triggered Stop Order	A triggered stop order is a stop order whose stop price has been reached in a trade event or a BBO change, thereby releasing the stop order so it can be traded.
IBBO	The ISE Best Bid or Offer.
ABBO	Away Best Bid or Offer, the away market best bid or offer, which is the National Best Bid or Offer excluding ISE data.
NBBO	National Best Bid or Offer, all exchanges Best bid or offer.

1.6 Priority

The priority is high.

1.7 Related Documents

Trading Functions

DFS3810 Production Matcher Part A

Market Data Interface (MDI) Programming Manual

Competitors' Opening Rules

Chapter 2 Overview

This chapter provides an overview of the opening process for the ISE exchange.

2.1 Current Behavior

In summary, current algorithm determines a price range for the open, and then determines the maximum quantity and price at which the open within that range can occur. Today away market protection on the open does not exist. The opening algorithm does not consider ABBO when determining boundary price interval or opening price. Additionally in a number of cases the determination and handling of imbalance conditions can prevent the opening process from successfully opening the market. See Chapter 1 for more info. See Section 1.2 for detailed description.

2.2 Overview of New Functionality

Although, parts of the existing opening functions will be leveraged, the new opening algorithm will be modified to include the consideration of the ABBO. New rules will be provided that modify the determination of the boundary price(s) as well as the determination of the price(s) at which the open can occur. Additionally, the algorithm moves away from a single price open and eliminates the imbalance conditions the current opening process faces.

2.3 Assumptions

Following are some assumptions:

- ISE and Gemini exchanges will follow the same opening rules.
- Pre-Open checks will remain unchanged.
- The process of feeding Contingency orders and Reserve orders remain unchanged.

2.4 Rollout

Due to the complexity and potential impact of this change, the rollout must be controllable to minimize risk and provide the ability to monitor the effect of the change on the marketplace. The new opening algorithm will be introduced on a product-instrument type basis. On day one of new software deployment current opening algorithm will be used in both ISE and Gemini markets (if Gemini is launched before opening change) and the new opening algorithm will be introduced later in both markets on a controlled basis. A product–instrument type rollout will allow introducing new algorithm in simple instruments for a symbol while keeping the old algorithm for the complex instruments in the same symbol. Additionally, this type of configuration will allow for introducing the new algorithm in one market while keeping the old algorithm in the second market. For example IBM in Gemini may use new algorithm while IBM in ISE will stay on the old algorithm.

Chapter 3 Functional Requirements

3.1 Summary

The functional requirements cover the following areas:

Section 3.2 provides a high level overview of the current opening process. The readers familiar with the current opening process can skip this section if they choose so. For detailed information on current opening process refer to: DFS 3610 Production Matcher Part A, Functional Overview, "Determination of the Opening Price"

Section 3.3 highlights the issues faced in the current opening process.

Section 3.4 describes the high level principles to improve the opening process algorithm.

Section 3.5 describes the new opening algorithm.

3.2 Current Opening Overview

This section provides an overview of the current opening process. Currently the opening goes through the following steps.

- Step 0 prerequisites for opening process
- Step 1 boundary price interval is determined.
- Step 2 opening price is determined without boundary prices.
- Step 3 opening price is determined with boundary prices.
- Step 4 Trades are allocated.
- Step 5 Orders that do not participate in the initial opening price size calculation are handled.

3.2.1 Determine The Boundary Price Interval

A boundary price interval ensures the opening price is close to the reasonable price range for an instrument. In general the PMM quote is used for the boundary price. If the PMM is not present on any side the highest quote from the CMMs is used. If there is no buy quote at all the boundary price is set to minimum price for the instrument. If there are no quotes on the sell side, the instrument cannot be opened.

There are variations to the boundary price calculations controlled by configurable parameters as described below.

- Instead of using PMM or CMM quotes, weighted average of all market maker quotes is used to determine boundary price. This configurability is available on a product by product basis. Currently all products are opened using PMM/CMM quotes and weighted average principle is not applied.
- The opening price adjustment parameter is used to widen the boundary prices. Currently the boundary prices are not adjusted, i.e. the value of this parameter is set to 0.
- The boundary prices can be ignored by setting a ignore boundary prices flag. Currently boundary prices are not ignored in production.

Note, if the buy boundary price is greater than the sell boundary price no opening price can be found, and the instrument goes into imbalance state.

3.2.2 Determination of Opening Price Without Boundary

To determine the opening price, the accumulated quantity for each price level is calculated for the buy and sell sides. Only quotes, market orders, and displayed quantities of limit orders are used to calculate the accumulated quantity. The hidden quantity of Reserve orders, AON/MEQ, Tick worse quotes, and stop orders is not used.

The opening price is calculated as the price level where maximum quantity can be traded, if there is no overlap between buy and sell prices the opening price cannot be calculated and the instrument is opened without a trade.

If there are multiple price levels with the same maximum quantity the arithmetic mean of price levels is used as the opening price. If there are market orders on one side the arithmetic mean cannot be calculated and the limit price on the opposite side is used as the opening price.

If there are only market orders on both sides no opening price can be found and instrument goes into imbalance.

If the bid-side boundary is one tick or less (could be zero), and the ask side best price is less than or equal to $0.40, and there is more sell market order quantity than bid quantity, then market orders are converted to limit orders for 1 tick, and the opening price is recalculated without boundaries.

3.2.3 Determination of Final Open Price

If the opening price calculated in the previous step is at or inside the boundary, then this is the final open price.

If the opening price is outside the boundary price interval, the instrument goes into imbalance unless same quantity can be traded at the boundary price corner.

If no final opening price can be found, the instrument goes into imbalance.

3.2.4 Opening Trade and Allocation

Once the opening price of an instrument has been determined, orders and quotes on the book for the instrument at the opening are matched to trade. The quantity that can trade at the opening is the lesser of the buy and sell side quantities on the book. Orders and quotes are matched as follows:

1. Market orders trade first, and can match with other market orders, quotes, and limit orders. If market orders on either or both sides cannot be traded entirely the instrument goes into imbalance.
2. Bid quotes and bid limit orders priced higher than the opening price and ask quotes and ask limit orders priced lower than the opening price trade next
3. If *custPriorityFlag* is set to On, priority customer orders with a limit price equal to the opening price trade next in time priority; if *custPriorityFlag* is set to Off, priority customer orders at the opening price trade along with non-customer orders as defined in step (4) below. Currently in production this setting is On i.e. priority customers trade before non-customers
4. Any remaining quantity of quotes and limit orders at the opening price trade pro rata; however, if the *priceTme* flag is set to On, all orders and quotes with a limit price that is equal to the opening price are allocated one after the other in time priority. Currently in production this setting is Off i.e current allocation is pro-rata.

Only displayed quantity of orders and quotes participate in the opening. The AON/MEQ, hidden quantities of Reserve Orders, unelected Stop orders, and ticked-worse quotes do not participate in the opening trade. They are handled after an instrument is set to regular state as described in the next section.

3.2.5 Handling orders that do not participate in the initial opening price size calculation

If the opening is successful, the instrument is set to regular, and the remaining quantity of opening only orders is deleted. Following subsequent steps are performed after a successful opening.

- All fully matched quotes are ticked worse and their price is adjusted 1 tick inferior to the opening price if needed.
- Stop orders are elected if eligible.
- MEQ and AON orders are fed one at a time.
- Reserve Orders are refreshed.

If any of the above orders cross or lock the IBBO, these orders trade 1 tick better than the IBBO. If any of above orders cross or lock the ABBO, they are handled as standard ABBO management. (For example: flashed, AMB locked, or cancelled as applicable).

3.3 Issues with Current Opening

One of the major issues with our current opening is the absence of the ABBO check. Due to this problem we may trade orders outside the other markets better prices. This issue has caused customer grievances when an order trades at ISE while it could have traded at a better price at another exchange. Some order flow providers have stopped sending pre-open orders to ISE because of this execution quality concern.

The second issue with our current opening algorithm is the imbalance conditions that happen due to a variety of reasons. An imbalance condition prevents the ISE from opening an instrument until PMM or Market Operations intervenes.

In Summary the following situations cause an imbalance.

- When there is a market order (s) that cannot be fully executed.
- When opening price or price range (if multiple price levels) is outside the boundary prices.
- If there are only market orders on both sides.
- When PMM quote on one side is missing and the best CMM quote on the other side is crossed with the PMM quote.

Following examples illustrate this concept:

Example 1	**Example 2**
PMM Qte 0 x 1.00	PMM Qte 0.90 x 0
CMM Qte 1.05 x 1.10	CMM Qte 0.80 x 0.85
Crossed Boundary 1.05 x 1.00	Crossed Boundary 0.90 x 0.85

The third issue with our current opening is treatment of price time priority for priority customers. At the same price, priority customers trade in price time fashion (controlled by the customer priority flag). The entry of orders in pre-open market is not necessarily an indication of when customer order was received by the ISE members. It's simply a matter of who starts their system early in the morning. There could be GTC orders from earlier days that were removed from ISE book on the previous day and re-entered in the pre-market hours. This

issue is also relevant to non-customers in standard complex instruments because all orders in non-quoted standard complex instruments trade in price-time priority.

Following examples illustrate the issues with current opening algorithm:

Example 1	**Example 2**
Ord1 B10@mkt Qte1 B10@0.98 Ord3 S30@mkt Qte2 S10@0.97 Since Sell 30@mkt cannot be fully executed, the instrument cannot be opened.	Ord1 B30@mkt Ord2 S10@mkt Since there are only market orders on the book, the instrument cannot be opened.
Example 3	**Example 4**
ABBO 10@1.00 x 10@1.05 PMM 10@0.99 x 10@1.04 Ord1 B10@1.00 Ord2 S20@0.98 Boundary:0.99 x 1.04 Opening Price : 0.99 This results into a trade outside the Away Market bid @ 1.00	PMM 10@0.99 x 10@1.04 Ord1 B10@1.00 Ord2 S20@0.98 Qte1 S10@0.98 Boundary: 0.99 x 1.04 Opening Price 0.98 This results into a trade outside the boundary price.

3.4 Principles to improve the opening process algorithm

The first key change in resolving the main issues is the inclusion of the ABBO when considering the boundary prices and protecting orders from trading through the ABBO prices.

The second key change is the modification of the algorithm to resolve conditions that prevent the opening process from successfully completing, and therefore remain in an imbalance state. By removing a single price open, the boundary price determination will not restrict tradable interest from executing within a single boundary, rather permit additional tradable interest to execute at multiple prices.

3.4.1 Inclusion of ABBO

If there is an ABBO available for an instrument (away has opened before ISE), the ABBO will be used in boundary price intervals. All customer orders will be prevented from trading through the away market prices. Note: quotes and non-customer orders can still trade through the away market prices.

If ABBO is inverted, the ABBO prices will not be used in the boundary price determination however customer orders will still be protected from trading through.

Orders that cannot participate in the opening due to the ABBO restrictions will be handled in a similar fashion as during the regular market. The priority and professional customer orders will be flashed, AMB locked and linked out. If an order is designated with Do Not Route, the new opening will respect the DNR flag and be processed as done during the regular market.

During the opening, regardless of non-customer flash settings, non-customer orders will NOT be flashed and cancelled as done during regular trading. Currently flash is only optional for non-customers.

3.4.2 Remove Single Price Open

An opening will happen at multiple price levels by calculating opening prices multiple times with different boundary price intervals.

3.4.3 Market Order Handling During the Opening Process

Market orders that cannot trade during the opening process will be handled in a similar fashion as they are handled during regular market hours.

3.4.3.1 Customer Orders

- Priority customer orders and Professional Customer orders will either be flashed/routed if there is an ABBO as done during regular trading.
- If there is no ABBO, leftover customer and customer professional market orders get three-tick lock if applicable and after the opening iterations, upon three-tick release gets a market order lock if applicable as done during regular trading.
- Note if the market order has matched the complete opposite side of the book customer orders may simply get a market order lock without getting 3-tick lock.
- Additionally as done during regular trading upon release; Sell market orders will be converted to the lowest tick and placed on the book. Buy market orders will be placed on the book unchanged. When the acting PMM is not found the incoming market order cannot be locked and will therefore cancel any balance after receiving 3-tick protection. As well, when there is no PMM, no ABBO, and no Bid; then Sell market orders will not convert to lowest tick, but will be cancelled.~~simply follow the behavior described above without a release.~~

3.4.3.2 Non-Customer Orders

- Unlike regular trading today, regardless of ABBO; the awayMarketHandlingCCAllowed configuration and the DoNotFlashCCAllowed configuration do not apply for non-customer orders. They do not get ABBO protection; i.e. will not be flashed and will not be cancelled as done during regular trading.
- Additionally regardless of ABBO, non-customers may receive 3-tick protection and be cancelled if applicable. As in regular trading today any non-customer market orders left after the opening will not lock, but will be cancelled.
- Note in some cases non customer market orders may simply cancel without 3-tick protection.
- For Non-customer orders, regardless of whether there is an acting PMM, 3-tick protection is provided and any balance is then cancelled.

Note 3-tick protection with no acting PMM, is different for the open than during regular trading. The table below illustrates the Customer, Customer Professional, and Non-customer 3-tick behavior with and without a PMM present.

	Acting PMM	No Acting PMM

Customer / Cust-Professional	3-tick lock, upon release trade/post to book	3-tick protect, cancel balance
Non-customer	3-tick protect, cancel balance	3-tick protect, cancel balance

The following examples illustrate non-customer market orders handling concept.

Example 1: Non-Customer Order 3-tick Protection & Cancel Balance PMM 10@0.04 x 0.08 Non Cust Sell 20@Market Qte B5@0.02 Iteration 1 – PMM boundary Trade 10@0.04 Iteration 2 – 3-tick boundary Trade 5@0.02 Non Cust balance Sell5@Mkt is cancelled	Example 2: Non-Customer Order Balance Cancels Without 3-tick Protection PMM 10@0.01 x 0.04 Non Cust Sell 11@Mkt Trade 10@0.01 Non Cust Balance Sell 1@Mkt is cancelled
Example 3: Non-Customer Order Cancels Without 3-tick Protection PMM 0 x 0.04 Non Cust Sell 11@Mkt No Trade Non Cust Sell11@Mkt is cancelled	

3.4.4 Opening Only Order Handling During the Opening Process

Opening Only Orders will follow much of the current defined behavior, however with the new opening they will not flash or lock as a result of ABBO protection, nor receive Three Tick or Market Order protection. Rather they will simply be cancelled, if they need to be protected.

3.4.5 Modified Allocation

To provide a fair treatment to all pre-market orders a new random allocation concept will be introduced among orders and quotes at the same price level.

Priority Customer orders with the same limit price in the regular order book and complex order book is currently executed in time priority during the opening. The Exchange believes executing these orders on a random basis is a fairer approach because the current time priority is dependent on when such orders are communicated to the Exchange by a Priority Customer's broker, not the time the Priority Customer expressed interest in doing the trade. Executing these orders in random will provide Priority Customer orders an equal opportunity to participate at the open.

Additionally, all other orders and quotes with the same limit price in the complex order book are currently executed in time priority during the opening. The Exchange believes executing these orders on a random basis is a fairer approach because the current time priority is dependent on when such orders and quotes are communicated to the Exchange, not the time the order or quote originator expressed interest in doing the trade. Executing these orders and quotes in random will provide them an equal opportunity to participate at the open.

3.4.6 Iterative Opening Process

The new opening process is an iterative process. In the first iteration, the trading system attempts to derive the opening price to be at or better than the ISE market maker quotes and ABBO prices. When there is executable interest, i.e., there are quotes or orders on the Exchange that lock or cross each other, the trading system will first calculate the Boundary Price. As is the case today, the trading system will use quotes provided by the PMM for the series in question to set the Boundary Price. If the PMM is not present on any side then the best quotes from the CMMs are used on the corresponding side. ISE Market Maker quotes therefore are the PMM's best bid and offer, or in the absence of a PMM quote, best bid and offer of CMMs. If there are no PMM or CMM quotes on the bid side, the minimum trading increment for the option class is used on the bid side. If there are no PMM or CMM quotes on the offer side, the options class will not open. If the options class is open on another exchange, the Boundary Price is determined to be the higher of the ISE Market Maker's bid in that options class and the national best bid, and the lower of the ISE Market Maker's offer in that options class and the national best offer. Reference section 3.5.2.1 for detailed description.

Once the trading system has determined the Boundary Price, it then determines the price at which the maximum number of contracts can trade at or within the Boundary Price (the "execution price"). Once the trading system determines the execution price, orders and quotes are processed as follows. At the execution price, market orders will be given priority before limit orders and quotes, and limit orders and quotes will be given priority by price. For limit orders and quotes with the same price, priority will be accorded first to Priority Customer Orders over Professional Orders and quotes. Priority Customer Orders with the same limit price will be executed in random order (reference section 3.4.5) while Professional Orders and quotes with the same limit price will be executed pro-rata based on size. If there remain any Public Customer Orders that would lock or cross a bid or offer from another exchange, they will be processed as provided by away market protection functionality. Any remaining Non-Customer Orders that would lock or cross a bid or offer from another exchange may trade outside the Boundary Price by up to three trading increments as further described under the third iteration below.

For example, suppose the following market in option class A:

Away Market BBO: 10 @ 1.00 x 10 @ 1.05

ISE PMM Quote: 10 @ 1.01 x 10 @ 1.04

ISE CMM Quote: 10 @ 0.90 x 50 @ 1.03

Suppose further the following buy and sell orders in option class A:

Priority Customer 1 Order: Buy 5 @ 1.00

Non-Customer 1 Order: Buy 5 @ 1.00

Non-Customer 2 Order: Buy 5 @ 0.95

Priority Customer 2 Order: Sell 50 @ 0.96

Non-Customer 3 Order: Sell 50 @ 0.95

Non-Customer 4 Order: Sell 50 @ 0.95

In the above example, since the ISE PMM quote is better than the away market quote, the Boundary Price is calculated using the ISE PMM quote, or 1.01 x 1.04. The highest bid at ISE is 1.01 and lowest offer is 0.95. To keep the trade within Boundary Price, the opening trade would be executed at 1.01 as follows:

- ISE PMM buys 10 contracts
- Non-Customer 3 and Non-Customer 4 sell 5 contracts each using the pro-rata allocation method

If after the first iteration there remain unexecuted orders and quotes that lock or cross each other, the trading system will initiate a second iteration. In the second iteration, the trading system uses either the ISE market maker quotes or the ABBO prices, whichever was not used in the first iteration. For example, if the ISE market maker quotes were used in the first iteration, the second iteration will use ABBO prices, and vice versa. If there were no ABBO prices for consideration in the first iteration, then the price used in the first iteration is widened by three trading increments. The trading system then determines the price at which the maximum number of contracts can trade at or within the widened Boundary Price. Once the trading system determines the execution price following the second iteration, orders and quotes are processed as follows. At the execution price following the second iteration, market orders are given priority before limit orders and quotes, and limit orders and quotes are given priority by price. For limit orders and quotes with the same price, priority is accorded first to Priority Customer Orders over Professional Orders and quotes. Priority Customer Orders with the same limit price are executed in random order while Professional Orders and quotes with the same limit price are executed pro-rata based on size. If there remain any Public Customer Orders that would lock or cross a bid or offer from another exchange, they will be processed as provided by away market protection functionality. Any remaining Non-Customer Orders that would lock or cross a bid or offer from another exchange may trade outside the Boundary Price by up to three trading increments as further described under the third iteration below.

In the example above, the following orders and quotes remain on the ISE order book following the first iteration:

ISE PMM Quote: 0 @ 0.00 x 10 @ 1.04

ISE CMM Quote: 10 @ 0.90 x 50 @ 1.03

Priority Customer 1 Order: Buy 10 @ 1.00

Non Customer 1 Order: Buy 5 @ 1.00

Non Customer 2 Order: Buy 5 @ 0.95

Priority Customer 2 Order: Sell 50 @ 0.96

Non Customer 3 Order: Sell 45 @ 0.95

Non Customer 4 Order: Sell 45 @ 0.95

The trading system will then initiate a second iteration. Since in the first iteration the Boundary Price was calculated using the ISE PMM Quotes, the second iteration will use away market prices that were not used in the first iteration and the Boundary Price is calculated at 1.00 x 1.05. The highest bid at ISE is now 1.00 and lowest offer is 0.95. To keep the trade within boundary, the second opening trade will be executed at 1.00 as follows:

- Priority Customer 1 Order buys 10 contracts
- Non-Customer 3 and Non-Customer 4 sell 5 contracts each using the pro-rata allocation method

If after the second iteration there remain unexecuted orders and quotes that lock or cross each other, the trading system will initiate a third iteration. In the third iteration, the Boundary Price, i.e., the price used in the second iteration, is widened by three trading increments. If there was no ABBO or an inverted market and the second iteration already used the widened boundary of three trading increments, the trading system does not calculate a new Boundary Price, and the trading system will simply trade any remaining quote interest. The trading system then determines the price at which the maximum number of contracts can trade at or within the widened Boundary Price. Once the trading system determines the execution price following the third iteration, orders and quotes are processed as follows. At the execution price following the third iteration, market orders are given priority before limit orders and quotes, and limit orders and quotes are given priority by price. For limit orders and quotes with the same price, priority is accorded first to Priority Customer Orders over Professional Orders and quotes. Priority Customer Orders with the same limit price are executed in random order while Professional Orders and quotes with the same limit price are executed pro-rata based on size. Thereafter any unexecuted Priority Customer Orders that lock or cross the Boundary Price are handled by the PMM and any unexecuted Non-Customer Orders that lock or cross the Boundary Price are canceled.

In the example above, the following orders and quotes remain on the ISE order book following the second iteration:

ISE PMM Quote: 0 @ 0.00 x 10 @ 1.04

ISE CMM Quote: 10 @ .90 x 50 @ 1.03

Non-Customer 1 Order: Buy 5 @ 1.00

Non-Customer 2 Order: Buy 5 @ .95

Non-Customer 3 Order: Sell 40 @ .95

Non-Customer 4 Order: Sell 40 @ .95

The trading system will then initiate a third iteration. In the third iteration, the Boundary Price is widened by three trading increments and is calculated to be 0.98 x 1.07. The highest bid at ISE remains at 1.00 and lowest offer remains at 0.95. To keep the trade within the Boundary Price, the third opening trade will be executed at 0.98 as follows:

- Non-Customer 1 Order buys 5 contracts
- Non-Customer 3 and Non-Customer 4 sell 5 contracts each using the pro-rata allocation method

Since remaining quantity of Non-Customer 3 and Non-Customer 4 orders are priced more than three trading increments away, these orders are cancelled.

If after the third iteration there remain unexecuted orders and quotes that lock or cross each other, the trading system will initiate a fourth and final iteration. In the fourth iteration, the trading system does not calculate a new Boundary Price. The trading system will simply trade any remaining quote interest. Thereafter the trading system opens the options series by disseminating the Exchange's best bid and offer.

Continuing with the example above, following the third iteration, the following orders and quotes remain on the ISE order book:

ISE PMM Quote: 0 @ 0.00 x 10 @ 1.04

ISE CMM Quote: 10 @ 0.90 x 50 @ 1.03

Non-Customer 2 Order: Buy 5 @ 0.95

Since there are no marketable orders or quotes left on the ISE order book, the trading system begins the process to trade the remaining quote interest by opening the option to trade 5 contracts @ 0.95 bid and 50 contracts @ 1.03 offer.

Additional considerations:

- Non-Customer orders, Away Market protection will not apply; i.e. non-customer orders will ignore the Away Market Handling configuration also referred to as awayMarketHandlingCCallowed.
- Priority Customer and Customer Professional orders will continue to get Away Market protection as done during regular trading and will follow current production configurations; i.e. Priority Customer and Customer Professional orders follow the Away Market Handling configuration also controlled by the awayMarketHandlingCCallowed.
- For Three-Tick Rule condition to be activated, it is required that orders or quotes on the book would actually execute at or beyond the 3-ticks; i.e. the following applies:
  - If the order book is not crossed the principal of 3-tick protection is not used.
  - If the order book is crossed and there is a trade at or beyond 3-ticks the protection is used.

The following examples highlight and illustrate the difference when 3-tick protection is applied vs not applied:

Example 1: 3-tick does not apply - Order book is not crossed and No ABBO	Example 2: 3-tick is applied – Order book is crossed and No ABBO

PMM 0.89 x 1@1.15 Cust Sell 20@0.90 Open 0.89 x 0.90 No 3-tick protection	PMM 5@1.00 x 1@1.15 Qte2 B5@0.98 Cust Sell 20@0.90 Iteration 1 Trade 5@1.00 Iteration 2 3-tick boundary 0.98 Trade 5@0.98 3-Tick protection customer order @0.98, lock balance
Example 3: 3-tick does not apply – Order book is not crossed and ABBO is present ABBO 0.99 x 1.15 PMM 5@0.89 x 1.15 Non-Cust Sell 20@0.90 Open 0.89 x 0.90 No 3-tick protection	Example 4: 3-tick is applied – Order book is crossed and ABBO is present ABBO 0.99 x 1.15 PMM 5@1.00 x 1.15 Qte2 B5@0.97 Non-Cust Sell 20@0.90 Iteration 1 Trade 5@1.00 Iteration 2 ABBO boundary 0.99 No trade, book is crossed @0.90, but only tradable @0.99 boundary Iteration 3 3-tick boundary 0.97 Trade 5@0.97 3-tick protection non-customer @0.97, cancel balance

Contingent orders, such as All-Or-None Orders, Stop Orders, Stop Limit Orders, Reserve Orders (non-displayed portion) and Minimum Quantity Orders, received prior to the open follow a feeding process as described in sections 3.6, 3.6.1, and 3.6.2

The diagram on next page illustrates the concept of iterative opening:

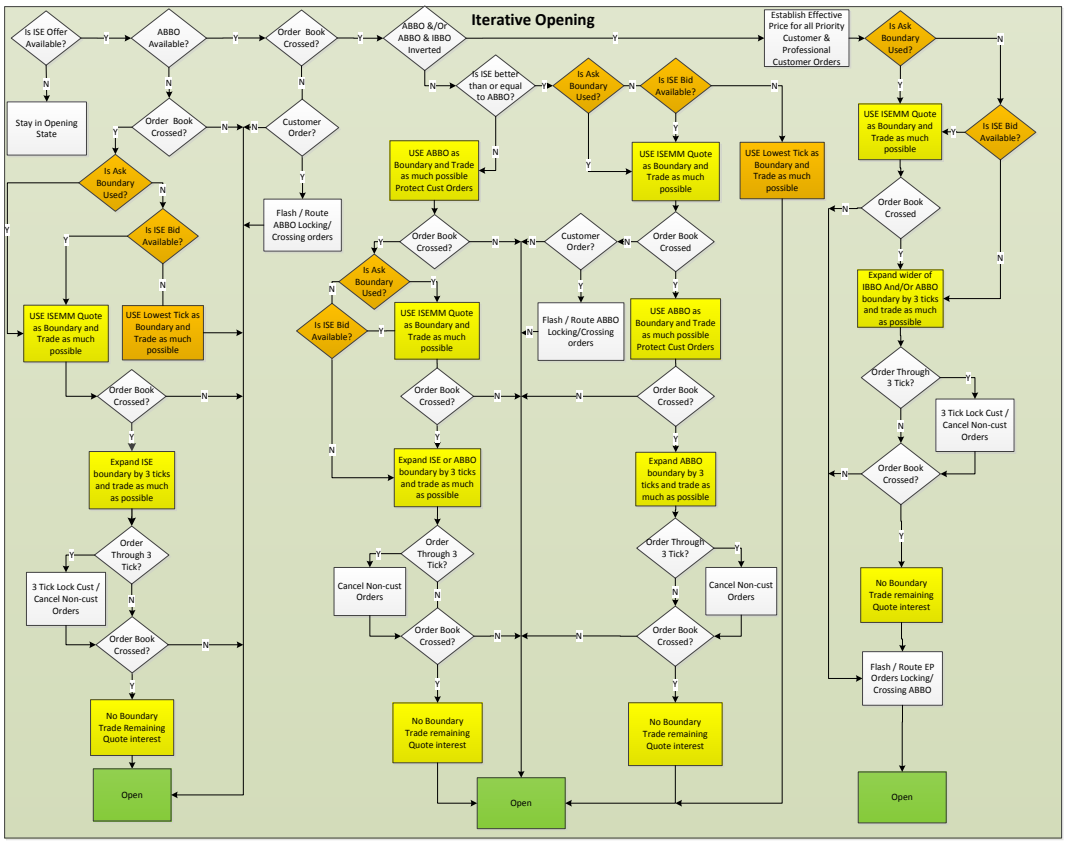

Figure 1: Iterative Opening Flowchart

3.5 New Opening Algorithm

The new opening process will go through the following steps:

Prerequisites for opening process

Iteration 0

- Inverted market is determined.
- Only if there is an inverted market, Effective Price for Priority and Professional Customer orders is determined.

Iteration 1

- Boundary price interval is determined
- Preliminary opening price is determined
- Final opening price is determined
- Trades are allocated

- Orders are protected and removed as needed

Iteration 2

If there are marketable orders and quotes still outstanding after iteration 1, the following steps will performed:

- A new wider boundary price interval is determined if needed
- A new opening price is determined
- A final opening price is determined
- Trades are allocated
- Orders are protected and removed as needed

Iteration 3

If after Iteration 2, there remains marketable interest, this means there are only quotes and/or non-customer orders remaining on the aggressive side interest.

The following steps will be performed if there remain non-customer orders and/or quotes:

- A new wider boundary price interval is determined if needed

A new opening price is determined.
A final opening price is determined
Trades are allocated.
Orders are protected and removed as needed

Iteration 4

If after Iteration 3, there remains marketable interest, this means there are only quotes remaining on the aggressive side interest; the following steps will be performed:

- A new opening price is determined.
- Trades are allocated.

Note if there is an inverted market, Effective Priced orders are protected in the last iteration.

Final Step:

Orders that do not participate in the initial opening price size calculation are handled.

- Note stop orders must consider all traded price levels during a multiple price open. Additionally stop orders must consider the final IBBO after the open.
- Tick worse during the open will behave similar to current functionality; i.e. buy quote will deteriorate to a lower price and sell quote to a higher price according to its tick worse parameter. However the behavior is affected with the introduction of a multiple price open, for detailed description of the adjusted tick worse behavior reference section 3.5.7

  Note multiple flash auctions started during the opening process will terminate in sequence according to the start time of the flash auction.

3.5.1 Iteration 0

Before the main iterative opening process starts a determination is made whether there is special handling required for inverted markets. If there is an inverted market condition, reference section 3.5.6 inverted market handling and use of “Effective Price” concept. If no inverted market exists Iteration 1 is started.

3.5.2 Iteration 1

3.5.2.1 Determine the Boundary Price Interval

The boundary price calculation process will be changed along the following lines:

In the first iteration a tighter version of boundary prices will be used between ISE MM Quotes and ABBO, i.e. where ISE bid (ask) is greater than or equal (lesser than or equal) than ABBO bid (ask) the ISE bid (ask) will be used for the boundary price. Otherwise ABBO bid (ask) will be used for the boundary price. All orders and quotes tradable at or within this tighter boundary price interval will be matched.

Following diagram illustrates boundary price determination logic in iteration 1:

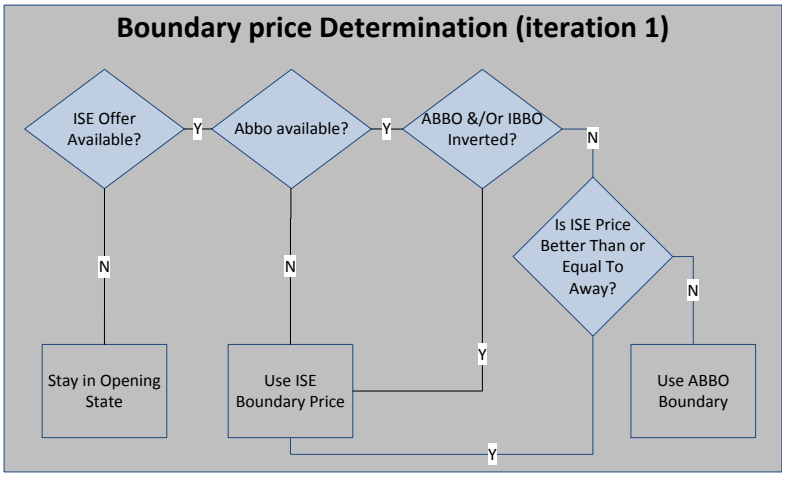

Figure 2: Boundary Price Determination (Iteration 1)

Following examples illustrates the concept of using tighter BBO:

Example 1	Example 2
ABBO 1.00 x 1.05	ABBO 1.00 x 1.05
IBBO 0.99 x 1.04	IBBO 1.05 x 1.10
Boundary = 1.00 x 1.04	Boundary = 1.05 x 1.05

If the ABBO is not available, ISE MM Quotes will be used as boundary prices (same as today).

Use the PMM quote, unless the PMM quote is missing on one side of the boundary the best CMM quote is used as the missing side boundary. Note however today this can cause a crossed boundary as noted in section 3.2.1 Hence a new uncrossing process is used, where the best CMM quote will be adjusted to a single price equal to the PMM price on the opposite side. Additionally note in the absence of a PMM sell side quote it is verified whether a configurable number of CMMs with sell side quotes is available. If the number of CMMs are less than the configuration, the opening process does not start.

The following examples illustrate the use of the best CMM quote as well as the uncrossing behavior when the best CMM quote crosses the opposite side PMM boundary:

Example 1 Best CMM Ask	**Example 2 Best CMM Bid**
PMM 1.00 x No Offer	PMM No Bid x 1.50
Best CMM 1.00 x 1.50	Best CMM 1.00 x 1.50
Boundary 1.00 x 1.50	Boundary 1.00 x 1.50
Example 3 Uncross CMM Bid	**Example 4 Using PMM quote**
PMM No Bid x 1.50	PMM 1.00 x 1.50
Best CMM 1.60 x 1.70	Best CMM 1.01 x 1.45
Boundary 1.50 x 1.50	Boundary 1.00 x 1.50

If no offer boundary is available, i.e. no ISE MM Quote offer, resulting from curtailment or ROM opening then the instrument will remain in an opening state as in current trading procedures.

If both sides of the boundary are CMM and they are crossed, no boundary price can be determined and the instrument will not open. Note this is the only case that will cause an imbalance. Although this imbalance case exists with the new opening, the functionality permitting the boundary to be ignored is no longer supported, reference section 3.2.1 and DTS section which covers the Ignore Boundary Price paramater. For operational use such as the Market Operations Marketwatch application the imbalance condition is still required so identification of this case is alerted and action can be taken.

The following example illustrates no PMM and only CMM quotes with crossed prices.

Example 1 No PMM, Crossed CMM Bid & Ask	**Example 2 No PMM, Crossed CMM Bid & Ask**
PMM no Bid x no Offer	PMM no Bid x no Offer
CMM1 B10@1.01 x 1.03	CMM1 B15@1.01 x 1.03
CMM2 0.47 x S10@0.50	CMM2 0.47 x S10@0.50

If the ABBO is inverted or the ABBO is inverted with the ISE MM Quotes reference section 3.5.6.1, variation to the boundary price determination.

Following Process Flow is a detailed view of the boundary price determination:

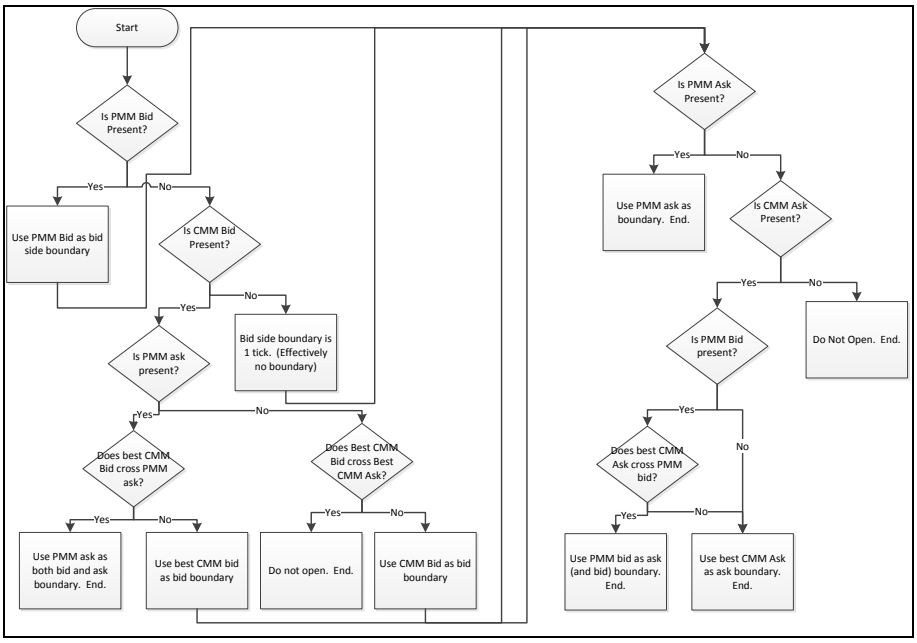

Figure 3: Boundary Price Determination in Iteration 1 – Process Flow

3.5.2.2 Determination of Preliminary Opening Price

In this step the matching engine employs the Accumulated Quantity Function (AQF) to determine the Preliminary Opening Price (POP). The AQF will determine the accumulated quantity, once for the buy side and once for the sell side, for each price level, for all regular market and limit orders and all quotes that could be executed at that price level. The Preliminary Opening Price is identified as the price level at which the maximum quantity of quotes, regular market orders, and displayed quantity of limit orders could be traded. If, after determining the quantities available to trade at each price level, there are multiple price levels with the same maximum quantity, the arithmetic mean of the prices at those levels will be calculated and used as the Preliminary Opening Price. If the arithmetic mean is between ticks, round down to the next lower valid tick. The hidden quantity of Reserve orders, AON/MEQ orders, tick worse quotes, and stop orders is not used.

Note AQF will only include valid tradable interest. Valid tradable interest includes Buy (Sell) orders greater (less) than or equal to the Bid (Offer) Boundary. By pre-determining and excluding the potential non-tradable interest below (above) the Bid (Offer) Boundary, the Trade and Allocation step is simplified; i.e. the Preliminary Open Price will equal the allocation price level.

The following example illustrates the AQF using valid tradable interest vs AQF using all interest.

ABBO 1.00 x 1.50
IBBO 5@0.95 x 5@1.60
O1 B100@0.91
O2 B5@0.95

O3 B10@0.93 O4 B10@0.97 O5 B10@1.10 O6 S20@0.90 O7 S10@0.98 O8 S1@1.10 O9 S1@1.55 Boundary 1.00 x 1.50

Example 1: AQF using all potential interest	**Example 2**: AQF using valid interest
POP = 20@0.98	POP = 10@0.90 AQF
Buy side = PMM, O1, O2, O3, O4, O5	Buy side = O5
Sell side = O6, O7, O8, O9	Sell side = O6, O7, O8

Because only valid orders are included in the AQF as in Example 2, the Preliminary open Price becomes the allocation price and is immediately identified, therefore only the orders included in the AQF need to be checked for allocation at the POP price.

In contrast Example 1 illustrates the need to check each order and quote for possible execution as well as the allocation price relative to each orders limit.

Market orders will be included in the accumulated quantity function by considering market orders as available to trade up to a maximum or minimum price on the book. The formulas used to determine a price level to use in the AQF for buy (sell) market orders are shown below:

Buy Market Order Price = Max (Maximum Buy Price, Maximum Sell Price)

Sell Market Order Price = Min (Minimum Buy Price, Minimum Sell Price)

In cases in which there is no price available for one variable in the equation, the other price is taken as the maximum (minimum). For example:

Buy	**Sell**
30@mkt	10@0.99
	10@1.00

Buy Market Order Price = Max (Maximum Buy Price, Maximum Sell Price)
BMOP = Max (NA, 1.00
BMOP = 1.00

The accumulated quantity function (AQF) is described in detail below.

The accumulated quantity function is a monotonically falling step function for the buy side, and a monotonically rising step function for the sell side. Each step function can be represented by an equation:

Bid Accumulated Quantity at a Price Level = F(BidPrice) = $\sum_{i=Bid\ Price}^{i=MaxBid\ Price} AvailableBidQuantiy_i$

Ask Accumulated Quantity at a Price Level = F(AskPrice) = $\sum_{i=0}^{i=Ask\ Price} AvailableAskQuantiy_i$

The step functions, when graphed, provide a visual tool for understanding how the POP is determined. Figure 1, below, is the output of an Excel macro developed to graph the AQF step functions based on sample scenario data. The intersection of the two step functions represents the POP level.

- If there is one price level at the step function intersection, that price level is the POP.
- If there is more than one price level where the step functions intersect, the matching engine calculates the arithmetic mean from the price levels at the intersection and designates the mean as the POP.

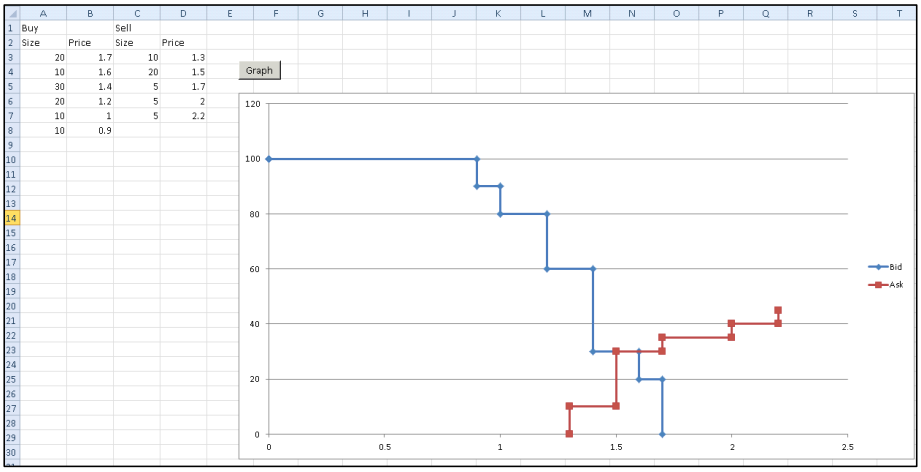

Figure 4: Accumulated Quantity Function Excel Macro

For a detailed description of the AQF using the Excel Macro, see Appendix A. Figure 4 shows the derivation of the POP using AQF.

The following example further illustrates Preliminary Open Price determination:

Buy	**Sell**
10@mkt	30@mkt
10@0.98	10@0.97
10@1.00	

Before running the AQF, a price must be determined for the market orders.

Buy Market Order Price = Max (Maximum Buy Price, Maximum Sell Price)
BMOP = Max (1.00, 0.97)
BMOP = 1.00

Sell Market Order Price = Min (Minimum Buy Price, Minimum Sell Price)
SMOP = Min (0.98, 0.97)
SMOP = 0.97

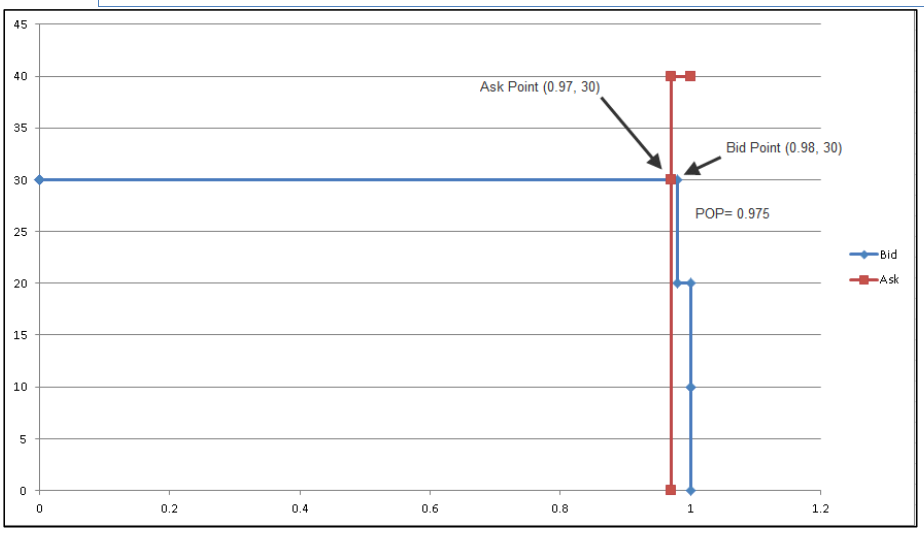

Figure 5: AQF Example

3.5.2.3 Determination of Final Open Price

This step will be similar to the current process, where opening price is adjusted to be at or within the boundary price. The new algorithm will differ from the existing method as follows:

0. Rather than only adjusting the Final Opening Price to be at or within the boundary price when there is an overlap range, the Final Opening Price will be adjusted to be at or within the boundary price in all cases.
1. When no final opening price can be found at or within the boundaries, the second iteration of boundary price calculation will be started after removing orders from the order book, see section 3.5.2.5 for order protection and removal and section 3.5.3.5

The following examples illustrate when no final open price can be found as in current opening compared to the new opening process where preliminary open price is adjusted to the boundary to become the final open price:

Example 1a: Current Open	**Example 1b:** New Open
PMM 10@1.00 x 10@1.05	PMM 10@1.00 x 10@1.05

Boundary = B10@1.00 x S10@1.05 Ord1 S20@0.95 Ord2 B20@0.95 Preliminary Open Price 20@0.95 is outside the boundary price therefore no final open price.	Boundary = B10@1.00 x S10@1.05 Ord1 S20@0.95 Ord2 B20@0.95 Preliminary Open Price 20@0.95 Preliminary open price adjusted to PMM boundary; Final Open Price = 10@1.00 Note the maximum quantity at the boundary is used which may be less than the original preliminary open price.
Example 2a: Current Open PMM 10@1.00 x 10@1.05 Boundary = B10@1.00 x S10@1.05 Ord1 S20@mkt Preliminary Open Price cannot be determined with a market order, therefore no final open price	**Example 2b**: New Open PMM 10@1.00 x 10@1.05 Boundary = B10@1.00 x S10@1.05 Ord1 S20@mkt Note Market order is considered @ lowest bid or offer limit price. Preliminary open price adjusted to PMM boundary; Final Open Price = 10@1.00 Note the maximum quantity at the boundary is used which may be less than the original preliminary open price.

Note when there are only orders on the book due to a curtailment event during the opening process and no other CMM quote is available to use as the boundary, or when ROM has initiated the open and a boundary price cannot be determined; the ABBO will not be used and the instrument will remain in an opening state as in current trading procedures.

Following diagrams illustrate the concept of preliminary and final opening price:

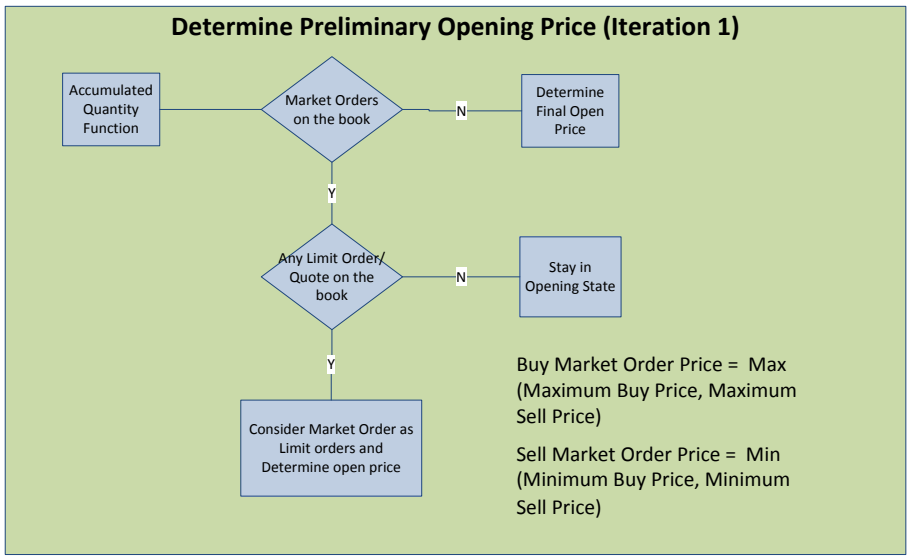

Figure 6: Determine Preliminary Opening Price (Iteration 1)

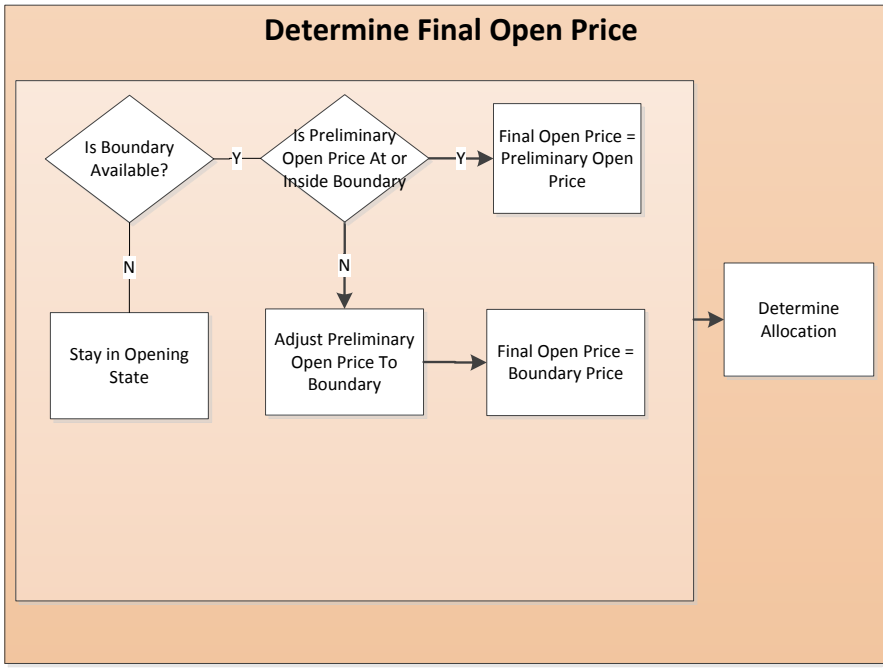

Figure 7: Determine Final Open Price – Iteration 1

3.5.2.4 Opening Trade and Allocation

Trade and allocation will be similar to the current procedure including giving priority to market orders and limit orders priced better than the open price, but will consider the following exceptions:

- A new concept of random allocation will be introduced. Today priority customers on simple instruments and all client categories on complex instruments trade in price-time model. As mentioned in the problem section 3.3, the price time concept favors members starting their systems early. The random allocation will give fair treatment to all orders. Note although the allocation is price time, price priority still remains; it is just the time that is being mitigated by the random allocation. The allocation will be configured in the following way:
  - The customer priority and price time flags will be kept independently for opening and normal trading. In addition to the current pro-rata and price time options a new random option will be introduced for the *custAllocationAtOpen* and *generalAllocationAtOpen* Flags. In summary following three configurations will be used:
    1. *custPriorityAtOpen* Flag – To trade priority customers before or along with non-customers.
    2. *custAllocationAtOpen* Flag- To trade priority customers in price/time, pro-rata or random
    3. *GeneralAllocationAtOpen* Flag - To trade all orders in price/time, pro-rata or random

    If *custPriorityAtOpen* flag is set to off, *custAllocationAtOpen* flag will not be used. *GeneralAllocationAtOpenFlag* will control the allocation among all orders. Note if *custPriorityAtOpen* flag is set to on, non-customer orders follow the *GeneralAllocationAtOpen* setting.
  - If market orders on either or both sides cannot be traded entirely they will be traded as much as possible depending on the allocation model and second iteration of boundary price calculation will be used to handle the remaining quantity.
  - The remaining quantity of other limit orders and quotes will be handled in the second iteration as well.

The following examples illustrate the random allocation concept:

Example 1: Random Market Order Priority	**Example 2:**
Iteration 1 Ord1 B10@mkt Ord2 B10@mkt Ord3 B50@mkt Qte1 S55@1.00 Note priority selection: • Random between Ord1, Ord2, and Ord3 Orders participating in allocation selected randomly: Ord3 B50@mkt Ord1 B5@mkt Qte1 S55@1.00 Orders Quote remain on the book Ord1 B5@mkt Ord2 B10@mkt	Iteration 1 Ord1 B10@1.00 Ord2 B10@1.01 Ord3 B10@mkt Ord4 B10@1.00 Qte1 S25@1.00 Note priority selection: • Ord3 Mkt has 1st priority • Ord2 Better priced Lmt has 2nd priority • Random between Ord1 and Ord4 Orders participating in allocation selected randomly: Ord2 B10@1.01 Ord3 B10@mkt Ord4 B5@1.00 Qte1 S25@1.00

	Orders Quote remain on book Ord1 B10@1.00 Ord4 B5@1.00 As noted above market and better priced orders still retain priority; i.e. Ord2 & Ord3.

Note, as in regular trading and the old opening process, Customer Professional is considered a Non-Customer Order when considering allocation in the new opening process.

3.5.2.5 Order Protection and Removal

The following bullets describe order protection and removal.

- If in the 1st iteration there is an ABBO and it is equal to or better than the ISE MM Quote, all remaining Priority and Professional customer market and limit orders locking or crossing the ABBO on the corresponding side will be flashed/routed according to normal trading procedures. All quotes and non-customer orders (regardless of locking/crossing) will remain and stay on the book.
- ISO orders resting on the book, whether resulting from a released ISO, entered Day or GTC ISO and rests, or pre-open ISO, the order is subject to the ABBO protection during the initial opening or intraday rotation.
- If after the first iteration, there remains marketable quantity of orders/quotes (order book is still crossed) a second iteration is started.

The following example illustrates order protection and removal at the open.

Example 1 Priority or Professional customer Orders Protected	**Example 2** Priority or Professional customer Orders Protected
ABBO 10@1.00 x 10@1.05	ABBO 10@1.00 x 10@1.05
PMM 10@0.99 x 10@1.04	PMM 10@0.99 x 10@1.04
Ord1 B10@1.00	Ord1 B10@1.00
Ord2 S20@0.98	Ord2 S20@mkt
	Qte1 S10@0.98
Iteration 1	
Boundary: 1.00 x 1.04	Iteration 1
	Boundary: 1.00 x 1.04
Trade	
Ord1 B10@1.00	Trade
Ord2 S10@1.00 lvs S10@0.98	Ord1 B10@1.00
	Ord2 S10@1.00 lvs S10@mkt
Remove/Protect Orders	
Ord2 S10@0.98 flashed/amb locked	Remove/Protect Orders
	Ord2 S10@mkt flashed/amb locked

	Qte1 S10@0.98 Stays on book
Example 3: Mkt Order lock No ABBO PMM 10@0.99 x 10@1.04 Ord1 B20@mkt Iteration 1 Boundary Price = 0.99 x 1.04 Trade PMM S10@1.04 Ord1 B10@1.04 lvs B10@mkt Remove/Protect Orders Ord1 B10@mkt mkt order lock	

- Handling of partially locked or released orders during the new opening.
    - The introduction of ABBO protection during the new opening exposes a new condition not handled in the current opening. It is possible to have a partially released order participating in the new opening process. As such, a partially released portion from a previous locked order during the new open may AMB lock and not re-flash.

    The following example illustrates this point.

Example 1: Partial released order during new open First in regular IBBO 1.00 x 2.00 ABBO 1.00 x 1.90 Cust Ord1 B3@1.90, flashes, then AMB Locks ABBO 1.00 x 2.00 Partial Release of 1 Instrument Hals IBBO 1.00 x 2.00 ABBO 1.00 x 1.90 New Intraday Rotation Ord1 does not flash again, but receives AMB lock	

    - Additionally with partially locked orders, it is possible it needs deletion. Typically this is handled by removing the unlocked quantity and modifying the order quantity down. If this occurs during the new opening the partial released order will receive a “pending cancel”, which means that

any further released quantity will be deleted before it has a chance to trade. Note, LOR can still trade with the locked quantity.

- As well with partially locked orders during the open it is possible an order has a partial AMB lock and needs to Three Tick, or vice versa. When this happens the order will receive the existing lock type as done during normal trading.

3.5.3 Iteration 2

Iteration 2 functionality is described in this section.

3.5.3.1 Determine the Boundary Price Interval

The initial boundary used in iteration 1 will be removed and a wider boundary will be calculated as follows:

- If ISE was better than ABBO, the ISE MM Quote will be removed from the boundary and ABBO will be used as the new boundary on the corresponding side.
- If ISE was equal to ABBO, both the ISE MM Quote and ABBO will be removed from the boundary and 3-tick boundary will be used as the new boundary on the corresponding side. Note this only applies to Non-customer orders as customer orders are protected against the ABBO in the corresponding iteration.
- If ISE was not better than ABBO, the ABBO will be removed from the boundary and the ISE MM Quote will be used as the new boundary on the corresponding side.
- If there is no ABBO the next boundary will be 3 ticks below (above) the previous ISE MM bid (offer). This will prevent remaining Priority and Professional customer orders and non-customers from trading too far from reasonable prices. Three Tick concept will continue to use the current configuration parameter, reference the *threeTickRuleTicks* configuration.
- If there is an inverted market the ABBO is not considered as a boundary, therefore the ISE MM Quote will be removed from the boundary and the next boundary will be 3-ticks below (above) the lowest (highest) previous ISE MM or ABBO bid (offer). This will again prevent remaining Priority and Professional customer orders and non-customer orders from trading too far from reasonable prices. Note, unlike behavior during regular trading where non-customers are flashed, then cancelled; during the new opening ABBO iteration non-customers will not be flashed nor cancelled as previously described in section 3.4.6. This is because members currently do not expect their GTCs, to get cancelled but rather rest on the book if they don't trade in the opening. Additionally this can apply when an intra-day rotation is initiated. Additionally note non-customer 3-tick protection can occur during the new open due to the presence or absence of an ABBO. In contrast during regular trading the 3-tick protection only applies when there is no ABBO.

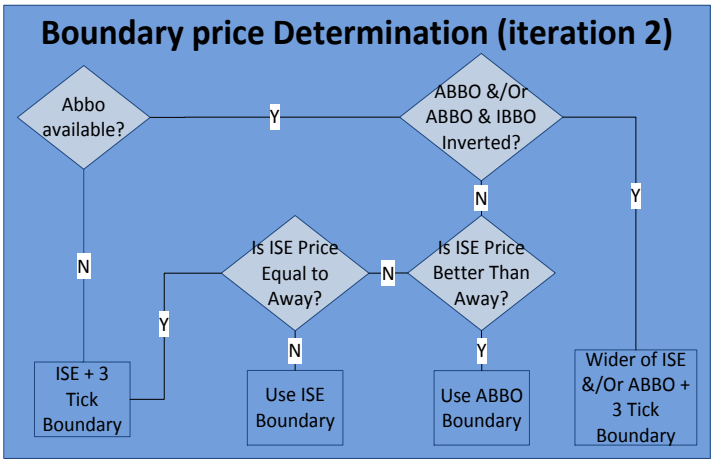

Figure 8: Boundary Price Determination – Iteration 2

The following examples illustrate a wider boundary determination in iteration 2. Note these examples only illustrate the general concept of widening the boundary in the second iteration and therefore assumes both sides of the boundary are wider. Reference section 3.5.4.2 for similar examples, however the boundary price only widens on the relevant side; i.e. the side that has aggressive tradable interest.

Example 1: Wider boundary using ABB & IBO ABBO 10@1.00 x 10@1.05 PMM 10@1.01 x 10@1.06 Iteration 1 Boundary price = 1.01 x 1.05 Iteration 2 Boundary price = 1.00 x 1.06	**Example 2**: Wider boundary using IBB & ABO ABBO 10@1.00 x 10@1.05 PMM 10@0.99 x 10@1.04 Iteration 1 Boundary price = 1.00 x 1.04 Iteration 2 Boundary price = 0.99 x 1.05
Example 3: Wider boundary using 3-tick w/o ABBO PMM 10@1.00 x 10@1.06 Iteration 1 Boundary price = 1.00 x 1.06 Iteration 2 3-tick Boundary price = 0.98 x 1.08	**Example 4**: Wider boundary using 3-tick w/ ABBO for non-customer orders ABBO 10@1.01 x 10@1.06 PMM 10@1.01 x 10@1.06 Iteration 1 Boundary price = 1.01 x 1.06 Iteration 2 3- tick Boundary price = 0.99 x 1.08

3.5.3.2 Determination of Opening Price Without Boundary

Preliminary opening price will be calculated in the same way as in iteration 1 with remaining quantity of marketable orders/quotes.

3.5.3.3 Determination of Final Opening Price

This step will be the same as in the first iteration if there is a boundary price; i.e., the opening price is adjusted to be at or within the boundary prices.

If there is no boundary the preliminary open price becomes the final open price.

If opening price cannot be adjusted to the boundary price a third iteration will be started after removing Priority and Professional customer orders from the book. See section 3.5.3.5 for order protection and removal in this iteration.

3.5.3.4 Opening Trade and Allocation

Trade and allocation will be similar to the current procedures outlined in iteration 1. If during the trade one side is completely exhausted, limit orders on the opposite side are posted on the book, and market orders are handled as in normal trading procedures.

3.5.3.5 Order Protection and Removal

If in the 2nd iteration the ABBO is used, i.e. ISE MM quotes were used in iteration 1, or ABBO is equal to ISE MM quotes in iteration 1; the remaining quantity of Priority and Professional customer market and limit orders locking or crossing the corresponding ABBO side are flashed/routed according to normal trading procedures. All quotes and non-customer orders (regardless of locking/crossing) remain and stay on the book.

If in the 2nd iteration 3 tick prices were used in the boundary (i.e. there is no ABBO), the remaining quantity of

- All priority and professional customer orders better than 3-tick will be locked to the PMM.
- All non-customer orders better than 3-tick will be cancelled.
- All quotes will stay on the book.

If one side interest is completely exhausted, the market orders on the opposite side will be handled as in normal trading procedures, i.e. Priority and Professional customer orders will be locked/booked, and non-customer orders will be cancelled.

If after second iteration, there remains marketable quantity of orders/quotes (order book is still crossed) a third iteration is started.

The following examples illustrate order protection and removal considerations in iteration 2.

Example 1: ABBO in 2nd iteration for Customer Orders	Example 2: 3-tick in 2nd iteration for Customer Orders
ABBO 10@1.00 x 10@1.05	No ABBO
PMM 10@1.01 x 10@1.06	PMM 10@0.99 x 10@1.04
Ord1 S20@0.98	Ord1 S20@mkt
Ord2 B5@1.00	Ord2 S10@0.90

Iteration 1 Boundary Price = 1.01 x 1.05 Trade PMM B10@1.01 Ord1 S10@1.01 lvs S10@0.98 Iteration 2 Boundary price = 1.00 x 1.05 Trade Ord2 B5@1.00 Ord1 S5@1.00 lvs S5@0.98 Remove/Protect Orders Ord2 S5@0.98 flashed/amb locked Mkt Opens 0 x 1.06 Note if Ord1 was non-customer it would not be flashed/amb locked and post through the ABBO.	Ord3 B15@0.96 Iteration 1 Boundary Price = 0.99 x 1.04 Trade PMM B10@0.99 Ord1 S10@0.99 lvs S10@mkt Iteration 2 Boundary price = 0.97 x 1.04 Trade Ord3 B15@0.96 Ord1 S10@0.96 Ord2 S5@0.96 lvs S5@0.90 Remove/Protect Orders Ord2 S5@0.90 3-tick lock Mkt Opens 0 x 1.04 Note if Ord2 was non-customer it would be cancelled.

3.5.4 Iteration 3

The 3rd iteration is reached if the ISE MM quote, ABBO or 3-tick was used in the 2nd iteration and resulted in remaining marketable quote or non-customer order interest that is still crossing the opposite side of the book. Note: by now all Priority and Professional customer order crossing the ABBO must have been removed.

If there are quotes or non-customer orders left on the book and either the ABBO or ISE MM was used in the 2nd iteration the new boundary will be 3-ticks below (above) the previous ISE MM or ABBO bid (offer). Although quotes will be afforded benefit of the 3-tick boundary, the main purpose is to prevent remaining non-customer orders from trading too far from reasonable prices. Note, if the ABBO is considered when determining 3-tick non-customer protection, the 3-tick price is always beyond the wider of the ABBO and the ISE MM price(s).

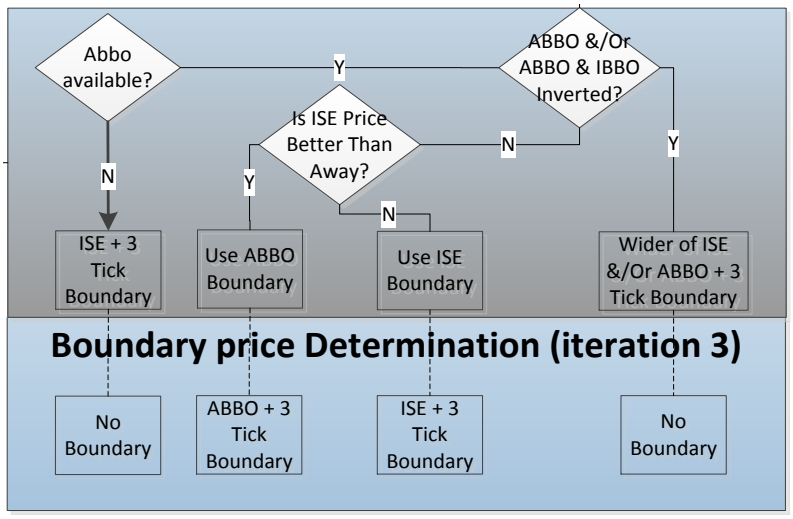

Figure 9: Boundary Price Determination – Iteration 3

The following examples illustrate the 3-tick for non-customer orders:

Example 1: ISE + 3-tick	Example 2: ABBO + 3-tick	Example 3: ISE + 3-tick & ABBO + 3-tick
ABBO 1.00 x 1.05	ABBO 1.00 x 1.05	ABBO 1.00 x 1.05
IBBO 0.99 x 1.06	IBBO 1.01 x 1.04	IBBO 0.99 x 1.04
Iteration 1, ABBO Boundary	Iteration 1, ISE Boundary	Iteration 1, ABBO & ISE Boundary
1.00 x 1.05	1.01 x 1.04	1.00 x 1.04
Iteration 2, ISE Boundary	Iteration 2, ABBO Boundary	Iteration 2, ISE & ABBO Boundary
0.99 x 1.06	1.00 x 1.05	0.99 x 1.05
Iteration 3, ISE + 3-tick Boundary 0.97 x 1.08	Iteration 3, 3-tick + ABBO Boundary 0.98 x 1.07	Iteration 3, 3-tick + ISE & 3 tick + ABBO 0.97 x 1.07

If after the third iteration, there remains marketable quantity of quotes (order book is still crossed) a fourth iteration is started.

3.5.4.1 Determination of Opening Price

Opening price will be calculated in the same way as in iteration 1 and 2 with remaining quantity of marketable orders/quotes, adjusted to the next boundary price.

3.5.4.2 Opening Trade and Allocation

Trade and allocation will be similar to the current procedures outlined in iteration 1 and 2. If during the trade one side is completely exhausted, limit orders on the opposite side are posted on the book, and market orders are handled as in normal trading procedures.

The following examples illustrate scenarios where iteration 3 is used.

Example 1: ABBO in Second Iteration for customer order	Example 2: 3-tick in Second Iteration for customer order	Example 3: 3-tick in Third Iteration for non-customer
ABBO 10@1.00 x 10@1.05	No ABBO	ABBO 10@1.00 x 10@1.05
PMM 10@1.01 x 10@1.06	PMM 10@0.99 x 10@1.04	PMM 10@1.01 x 10@1.06
Ord1 S20@0.98	Ord1 S20@mkt	Ord1 S50@0.97 …Non-cust
Ord2 B5@1.00	Ord2 S10@0.90	Ord2 B5@1.00
Ord3 B5@0.99	Ord3 B15@0.97	Ord3 B5@0.95
Qte2 S10@0.99	Ord4 B5@0.95	Qte2 S10@0.99
Iteration 1	Qte2 S10@0.95	Iteration 1
Boundary Price = 1.01 x 1.05	Iteration 1	Boundary Price = 1.01 x 1.05
Trade	Boundary Price = 0.99 x 1.04	Trade
PMM B10@1.01	Trade	PMM B10@1.01
Ord1 S10@1.01 lvs S10@0.98	PMM B10@0.99	Ord1 S10@1.01 lvs S40@0.97
	Ord1 S10@0.99 lvs S10@mkt	
Iteration 2		Iteration 2
Boundary price = 1.00 x 1.05	Iteration 2	Boundary price = 1.00 x 1.05
Trade	Boundary price = 0.97 x 1.04	Trade
Ord2 B5@1.00	Trade	Ord2 B5@1.00
Ord1 S5@1.00 lvs S5@0.98	Ord3 B15@0.97	Ord1 S5@1.00 lvs S35@0.97
	Ord1 S10@0.97	
Remove/Protect Orders	Ord2 S5@0.97 lvs S5@0.90	Remove/Protect Orders
Ord1 S5@0.98 flashed/amb locked		n/a – O1 is Non-cust can trade through ABBO
	Remove/Protect Orders	
Iteration 3	Ord2 S5@0.90 3-tick lock	Iteration 3
Boundary price = 0.98 x 1.05		Boundary price = 0.98 x 1.05
3-tick from ABBO	Iteration 3	3-tick from ABBO
Trade	Boundary price = 0 x 1.04	Trade
Ord3 B5@0.99	Trade	n/a
Qte2 S5@0.99 lvs S5@0.99	Ord4 B5@0.95	
	Qte2 S5@0.95 lvs S5@0.95	Remove/Protect Orders
Mkt Opens 0 x 5@0.99		O1 S35@0.97 3-tick protection and cancelled
	Mkt Opens 0 x 5@0.95	

		Mkt Opens 5@0.95 x 10@0.99

3.5.5 Iteration 4

The fourth iteration is only reached if the 3-tick protection after the ABBO or ISE MM was in the 3rd iteration and resulted in remaining marketable quote interest that is still crossing the opposite side of the book. Note: by now all Priority and Professional customer order crossing the ABBO must have been removed, and non-customer orders 3-tick with protection must have been removed.

Since only quotes are left on the book there will be no new boundary price calculated on the corresponding side.

3.5.5.1 Determination of the Opening Price

Opening price will be calculated in the same way as in iteration 1, 2, and 3 with remaining quantity of marketable orders/quotes. Since there is no boundary, the opening price does not need to be adjusted.

3.5.5.2 Opening Trade and Allocation

Trade and allocation will be similar to the current procedures outlined in iteration 1, 2, and 3. If during the trade one side is completely exhausted, limit orders on the opposite side are posted on the book, and market orders are handled as in normal trading procedures.

The following examples illustrate scenarios where iteration 4 is used.

Example 1: ABBO + 3-tick in Third Iteration for non-customer	**Example 2**: ISE + 3-tick in Third Iteration for non-customer
ABBO 10@1.00 x 10@1.05	ABBO 10@1.00 x 10@1.05
PMM 10@1.01 x 10@1.06	PMM 10@0.99 x 10@1.06
Ord1 S50@0.97 …Non-cust	Ord1 S50@0.95 …Non-cust
Ord2 B5@1.00	Ord2 B5@1.00
Ord3 B5@0.96	Ord3 B5@0.98
Qte2 S10@0.96	Ord4 B5@0.95
	Qte2 S10@0.95
Iteration 1	Iteration 1
Boundary Price = 1.01 x 1.05	Boundary Price = 1.00 x 1.05
Trade	Trade
PMM B10@1.01	Ord 2 B5@1.00
Ord1 S10@1.01 lvs S40@0.97	Ord1 S4@1.00 lvs S46@0.95
	Qte2 S1@1.00 lvs S9@0.95
Iteration 2	

Boundary price = 1.00 x 1.05 Trade Ord2 B5@1.00 Ord1 S5@1.00 lvs S35@0.97 Remove/Protect Orders n/a – O1 is Non-cust can trade through ABBO Iteration 3 Boundary price = 0.98 x 1.05 3-tick from ABBO Trade n/a Remove/Protect Orders O1 S35@0.97 3-tick protection and cancelled Iteration 4 No Boundary price Trade Ord3 B5@0.96 Qte2 S5@0.96 lvs S5@0.96 Mkt Opens 0 x 5@0.96	Iteration 2 Boundary price = 0.99 x 1.05 Trade PMM B10@0.99 Ord1 S8@0.99 lvs S38@0.95 Qte2 S2@0.99 lvs 7@0.95 Remove/Protect Orders n/a – O1 is Non-cust can trade through ABBO Iteration 3 Boundary price = 0.97 x 1.05 3-tick from IBBO Trade Ord 3 B5@0.97 Ord 1 S4@0.97 lvs 33@0.95 Qte 2 S1@0.97 lvs 7@0.95 n/a Remove/Protect Orders O1 S33@0.95 3-tick protection and cancelled Iteration 4 No Boundary price Trade Ord4 B5@0.95 Qte2 S5@0.95 lvs 1@0.95 Mkt Opens 0 x 2@0.95

3.5.6 Inverted Market and Locked Market

If during the boundary price determination the away market is inverted, such that the ABBO bid (ask) is greater (lower) than the ISE MM offer (bid) and/or the ABBO bid (ask) is greater (lower) than the ABBO ask (bid), then additional steps are required.

For locked markets no special handling is done. A locked market is identified when a bid price is equal to the offer price and can exist between the away market, the ISE market, or a combination of both.

The following examples illustrate different inverted cases as well as markets when they are locked:

ABBO and IBBO are Uncrossed	
Example 1: Away Bid inverted with ISE Offer ABBO 1.05 x 1.10 IBBO 0.95 x 1.00	
ABBO Locked and IBBO Locked	
Example 2: Away Bid inverted with ISE Offer ABBO 1.05 x 1.05 IBBO 1.04 x 1.04	
ABBO Locked and IBBO Uncrossed	
Example 3: Away Bid inverted with ISE Offer ABBO 1.05 x 1.05 IBBO 1.03 x 1.04	
ABBO Inverted and ISE Locked	
Example 4: Away Bid inverted with ISE Offer and Away Offer inverted with ISE Bid ABBO 1.06 x 1.04 IBBO 1.05 x 1.05	
ABBO Inverted and ISE Uncrossed	
Example 5: Away Bid & Offer inverted, and Away Offer inverted with ISE Bid ABBO 1.05 x 0.95 IBBO 1.00 x 1.10	Example 6: Away Bid & Offer Invertedand Away Bid is inverted with ISE Offer , and Away Bid is inverted with ISE Bid ABBO 1.10 x 0.95 IBBO 1.00 x 1.05
Example 7: Away Bid & Offer inverted, and Away Offer is inverted with ISE Bid–	Example 8: Away Bid & Offer Inverted ABBO 1.05 x 1.00

note better ISE bid ABBO 1.05 x 0.95 IBBO 1.06 x 1.10	IBBO 0.95 x 1.10

Much of the general iterative opening process is the same for handling inverted market scenarios; however there are three key differences which are described in the following sections.

3.5.6.1 Handling of Inverted Market Boundary Price Determination

The first key difference is prior to the boundary price determination process exclusion of the inverted boundary price(s). Since it is not discernible which BBO prices are accurate among inverted away prices and or ISE MM Quotes; the initial boundary price determination for inverted markets must exclude the inverted price(s) in order to achieve a non-inverted boundary price or simply consider the ISE MM Quotes for use in Iteration 1. Unlike non-inverted boundary price determination the exclusion of the ABBO is achieved using a concept of applying an "Effective Price" to Priority and Professional customer orders, described in further detail below. Note although the inverted prices have been excluded from consideration as part of the boundary prices, they are still valid for order protection.

The following concepts are applied to exclude inverted market prices prior to start of the first iteration.

1. Algorithm must identify an inversion - ISE prices will never be inverted, they can either be uncrossed or locked as noted in section 3.5.2.1, therefore the inversion can only exist among the ABBO only, one side of the ABBO with one side of the IBBO, or both sides of the ABBO with both sides of the IBBO.
2. Priority and Professional Customer order protection - next all customer market and limit orders are identified for protection from the ABBO, and will be treated with an "Effective Price".

    - Effective Price - is the price at which an order will be considered when comparing against an inverted ABBO, in effort to protect that order from trading at an inferior price. Priority and Professional Customer Buy (Sell) orders greater (less) than or equal to the away Offer (Bid) will be considered with an effective price equal to the away Offer (Bid). This will ensure orders are protected from inverted price(s) superior to the IBBO, as further described in the subsequent section on order protection during inverted market handling.

      The following examples illustrate the concept of effective price(s) and exclusion of inverted price(s) from the boundary. The resultant boundary price determination becomes the ISE MM Quotes which are then used for Iteration 1.

Example 1: Away Bid Inverted w/ ISE Offer ABBO 1.05 x 1.05 IBBO 1.03 x 1.04 O1 B@1.06 (effective price = 1.05) No Sell Order ABBO is excluded from consideration Boundary = 1.03 x 1.04	**Example 2**: Away Bid and Offer Inverted ABBO 1.06 x 1.04 IBBO 1.03 x 1.07 O1 B@1.05 (effective price = 1.04) O2 S@1.04 (effective price = 1.06) ABBO is excluded from consideration Boundary = 1.03 x 1.07
Example 3: Away Bid Inverted w/ ISE Bid And Away Bid & Offer Inverted	**Example 4:** Away Bid Inverted w/ ISE Offer ABBO 1.05 x 1.03

ABBO 1.06 x 1.04 IBBO 1.04 x 1.04 O1 B@1.05 (effective price = 1.04) O2 S@1.05 (effective price = 1.06) ABBO is excluded from consideration Boundary = 1.04 x 1.04	IBBO 1.03 x 1.04 Cust O1 B@mkt = 1.04 (effective price = 1.03) No Sell Order ABBO is excluded from consideration Boundary = 1.03 x 1.04 Note market order assigned highest limit is re-priced to use effective price due to tighter ABBO reference section 3.5.6.3 for further details

3. If there are no Priority and Professional customer orders that require protection, the opposite side inverted ABBO is automatically excluded, and Iteration 1 boundary will only use ISE MM quotes, since non-customer orders and quotes can trade through away prices.

   - Non-customer order protection – although non-customer orders can trade through the away market, they will still receive 3-tick protection. ~~Therefore, non-customer market orders will be considered with a price 3-ticks below (above) the lowest (highest) ISE and/or ABBO Bid (Offer).~~

     The following examples illustrate the boundary for non-customer orders after an inverted market is excluded.

Example 1: Away Bid inverted w/ ISE Offer ABBO 1.05 x 1.06 IBBO 1.03 x 1.04 N-cust O1 B@1.06 No Sell Order ABBO is excluded from consideration Boundary = 1.03 x 1.04	**Example 2**: Away Bid and Offer Inverted ABBO 1.06 x 1.04 IBBO 1.03 x 1.07 N-cust O1 B@1.05 N-cust O2 S@1.04 ABBO is excluded from consideration Boundary = 1.03 x 1.07
Example 3: Away Bid Inverted w/ ISE Offer And Away Bid & Offer Inverted ABBO 1.06 x 1.04 IBBO 1.04 x 1.04 N-cust O1 B@1.05 N-cust O2 S@1.05 Boundary = 1.04 x 1.04	**Example 4:** Away Bid Inverted w/ ISE Offer ABBO 1.05 x 1.05 IBBO 1.03 x 1.04 Non-cust O1 B@mkt = 1.04 No Sell Order ABBO is excluded from consideration Boundary = 1.03 x 1.04

4. Note allocation for effective priced orders is based on the original price of the order, and will follow allocation rules defined in section 3.5.2.4

3.5.6.2 Handling of Preliminary Opening Price Without Boundary

The second key difference is the step that determines the POP, or preliminary open price. This step is similar to the current POP step defined in Iteration 1 section 3.5.2.2, however the AQF function will use the "Effective Price" for Priority and Professional customer orders, to ensure customer orders are only calculated to trade up to the AQF price, thereby preventing trades through better ABBO price(s).

The following examples illustrate the use of the Effective Price when calculating the POP compared to POP during non-inverted market:

Example 1: Non-inverted boundary	**Example 2**: Away Bid and Offer Inverted
ABBO 1.04 x 1.06	ABBO 1.06 x 1.04
IBBO 5@1.03 x 5@1.07	IBBO 5@1.03 x 5@1.07
Cust O1 B10@1.07	Cust O1 B10@1.07 (effective price = 1.04)
N-cust O2 S5@1.04	N-cust O2 S5@1.04
Boundary = 1.04 x 1.06	ABBO is excluded from consideration
POP = 1.07	Boundary = 1.03 x 1.07
	POP = 1.04

Important Note: Although the ABBO has been excluded from the boundary price for inverted markets, the ABBO must still be considered when the order protection step occurs, as done during the general iteration steps. Reference the next section on Order protection during inverted markets.

3.5.6.3 Handling of Inverted Market Order Protection and Removal

The third key difference is the order protection and removal process. The main concept of protecting orders still applies as defined in section 3.5.2.5. For inverted markets however, special considerations are made.

1. Order protection and removal applies for Priority and Professional customer orders at their effective price, however, the flash and AMB lock applies to the original orders price as done during non-inverted opening and regular trading.
2. Effective Priced Priority and Professional customer orders remain available until the balance of such order cannot be executed and reaches or equals the opposite side BBO price, and is left to the last order protection step in the last iteration. This means Effective Priced orders may not be flashed and protected until the last iteration is complete.
3. During an inverted market, when Priority and Professional customer orders are market orders, they can be assigned as a limit order as defined in section 3.5.2.2 or assigned an Effective Price as defined in section 3.5.6.1. In which case they should be assigned as limit orders first in accordance with section 3.5.2.2. If however, the ABBO is more restrictive; i.e. Sell (Buy) ABBO is lower than the highest (lowest) price for buy (sell) order, re-price the market order to the Effective Price or ABBO price to prevent a trade through. In the event the ABBO is wider than the highest or lowest book limit price, do not re-price to the higher or lower respective ABBO price. Note the market order will still receive ABBO protection; i.e. flash/amb lock as a market order.
   Non-customer market orders will only be assigned as a limit order as defined in section 3.5.2.2 and not an effective price since they are not protected against the ABBO.
4. Although non-customer orders are not price protected against the ABBO, 3-tick protection for non-customer orders is still applied after the ISE Boundary or ABBO boundary is considered in a previous iteration.

The following examples illustrate effective price or limit price handling of market orders during inverted markets:

Example 1: Customer Market order w/ Effective Price, tighter ABBO ABBO 1.06 x 1.03 IBBO 1.01 x 1.04 Cust O1 B@mkt = B@1.04 Repriced Effective Price = B@1.03	Example 2: Customer Market order w/ Limit Price, wider ABBO ABBO 1.06 x 1.05 IBBO 1.01 x 1.04 Cust O1 B@mkt = B@1.04 Note, although there is no re-price to the ABBO, unexecuted balance of market orders will still receive protection.
Example 3: Non-Customer Market order w/ Limit Price, tighter ABBO ABBO 1.06 x 1.03 IBBO 1.01 x 1.04 Non-Cust O1 B@mkt = B@1.04	Example 4: Non-Customer Market order w/ Limit Price, wider ABBO ABBO 1.06 x 1.05 IBBO 1.01 x 1.04 Non-Cust O1 B@mkt = B@1.04

The following examples illustrate handling of non-customer market orders with 3-tick during inverted markets:

Example 3: Non-Customer Market order w/ 3-tick, tighter ABBO ABBO 1.06 x 1.03 IBBO 1.01 x 1.04 Qte S@1.08 N-Cust O1 B@mkt = B@1.08 3-tick Price Protection = B@1.06	Example 4: Non-Customer Market order w/ 3-tick, wider ABBO ABBO 1.06 x 1.05 IBBO 1.01 x 1.04 Qte S@1.08 N-Cust O1 B@mkt = B@1.08 3-tick Price Protection = B@1.07

The following examples illustrate the order protection using effective priced orders.

Example 1: Away Bid Inverted w/ ISE Offer ABBO 1.05 x 1.05 IBBO 5@1.03 x 5@1.04 Cust O1 B20@1.06 (effective price = 1.05) Cust O2 S5@1.05 ABBO is excluded from consideration	**Example 2**: Away Bid and Offer Inverted ABBO 1.06 x 1.04 IBBO 5@1.03 x 5@1.04 Cust O1 B10@1.05 (effective price = 1.04) Cust O2 S10@1.04 (effective price = 1.06) ABBO is excluded from consideration

Step 0 – we've established effective prices and excluded ABBO, then step into the normal iteration process below. Iteration 1 Boundary = 1.03 x 1.04 POP = 5@1.05 …AQF using effective price FOP = 5@1.04 …adjust to boundary Trade = 5@1.04 …O1 lvs balance 15@1.05 Order Protection = n/a …not done yet Iteration 2 Boundary = 1.03 x 1.07 (3-tick) POP = 5@1.05 FOP = 5@1.05 Trade = 5@1.05 …O2 & O1 lvs balance B10@1.05 Order Protection = O1 balance effective price 1.05 locks/crosses ABBO, O1 B10@1.06 flashed / amb locked	Step 0 – we've established effective prices and excluded ABBO, then step into the normal iteration process below. Iteration 1 Boundary = 1.03 x 1.04 POP = 5@1.04 FOP = 5@1.04 Trade = 5@1.04 …PMM & O1 lvs balance B5@1.04 Order Protection = O1 balance effective price 1.04 locks/crosses ABBO, O1 B5@1.05 flashed / amb locked O2 S10@1.04 flashed / amb locked O2 effective price 1.06 locks/crosses ABBO, O2 S10@1.04 flashed / amb locked. Note, difference between Ex1 and Ex2. After iteration 1 Ex1 had crossed interest, in Ex2 there was no crossed interest left, so orders were protected.
Example 3: Away Bid Inverted w/ ISE Offer And Away Bid & Offer Inverted ABBO 1.10 x 1.08 IBBO 5@1.04 x 5@1.04 Cust O1 B20@mkt (effective price = 1.08) Cust O2 S10@1.05 (effective price = 1.10) Q2 S10@1.07 Q3 S1@1.08 Q4 B5@1.10 ABBO is excluded from consideration Step 0 – we've established effective prices and excluded ABBO, then step into the normal iteration process below. Iteration 1	

Boundary = 1.04 x 1.04 POP = 5@1.08 …using the adjusted AQF only the B> boundary bid and A< boundary offer are used…so AQF = boundary bid, boundary offer and O1 FOP = 5@1.04 Trade 5@1.04 …leaves balance on O1 B15@mkt [1.08] Order Protection = n/a …not done yet Iteration 2 Boundary = 1.04 x 1.10 (3-tick) …this will be applied b/c of new non-customer protection rule POP = 11@1.08 …again using adjusted AQF only Q3 and O1 balance FOP = 11@1.08 Trade =11@1.08 …leaves balance on O1 B4@mkt [1.08] Order Protection = n/a Iteration 3 Boundary = n/a POP = 5@1.10 …adjusted AQF only Q4 and O2 FOP = 5@1.10 Trade = 5@1.10 …leaves balance of O2 S5@1.05 [1.10] Order Protection Ord1 B4@mkt [1.08] flash/amb effective price locks/crosses ABBO Ord2 S5@1.05 [1.10] flash/amb effective price 1.10 locks/crosses ABBO	

Comment [I1]: port sections from the DFS on uncrossing / feeding contingency orders.

Section 12.3.2 and 12.3.3

3.5.7 Modified Tick Worse Behavior

Tick worse behavior principal remains the same, i.e. the bid / offer are widened after a quote is fully traded out. However, with the new opening the behavior is affected. The impacted behavior can be seen by looking at the change in the behavior between the current single price open and the new multiple price open.

3.5.7.1 Current Tick Worse Behavior

Tick worse prices deteriorate at least by the tick worse parameter but also must be at least by enough ticks to make the price of the incoming quote outside or uncrossed with the opening price, i.e. Bid (Offer) must be lower (higher) than the open price by the minim tick worse parameter and must be at least 1 tick lower (higher) than the open price.

The following example illustrates this concept:

Example 1:	Example 2:
Opening Price = 0.92	Opening Price = 0.92
Traded Out Qte = S@0.90	Traded Out Qte = S@0.90
Tick Worse = 5 tick	Tick Worse = 1 tick
Tick Worse Price = S@0.95	Tick Worse Price = S@0.91
The tick worse price @0.95 is not crossed with the open price @0.92 so the tick worse price = 0.95.	The tick worse price @0.91 is crossed with the open price @0.92 so the tick worse quote is adjusted to 0.93, 1 tick outside the open price.

3.5.7.2 New tick worse behavior

The same basic concepts for tick worse is applied with regard to satisfying the minimum tick worse parameter and adjusting the tick worse quote if it locks or crosses the open price.

However with the new opening there are some additional concepts introduced. One is to handle multiple open prices. The second is to handle the uncrossing behavior which is potentially subject to a crossed opening BBO quote which can be inside or outside the opening prices. The following provides guidelines on how to determine the new tick worse behavior.

- The fully traded out quote will tick worse by the configured tick worse setting as done today.
- If there are multiple prices the last price is the price to consider as the opening price when considering the tick worse price.
- Unlike the current tick worse behavior, the new the tick worse price can be locked or crossed with the opening price and or the opening quote. So additional considerations must be made to uncross from the opening price as well as the opening quote. The following rules define how the uncrossing tick worse behavior will function:
    - Opening price is within the opening quote BBO
        - If the tick worse quote locks or crosses the last opening trade price, then adjust the tick worse quote to be 1 tick inferior to the opening price.

          The following examples illustrate this concept:

Example 1: Tick Worse Qte = B@0.96 Open Price = 0.96 Open Qte = 0.95 x 0.98 Open Price is within Open Qte Tick Worse Qte Locks/Crosses Open Prc Adjusted Tick Worse Qte = B@0.95	Example 2: Tick Worse Qte = S@0.96 Open Price = 0.96 Open Qte = 0.95 x 0.98 Open Price is within Open Qte Tick Worse Qte Locks/Crosses Open Prc Adjusted Tick Worse Qte = S@0.97

- If the tick worse quote does not lock or cross the last opening trade price, then use the tick worse quote.

  The following examples illustrate this concept:

Example 1: Tick Worse Qte = B@0.95 Open Price = 0.96 Open Qte = 0.95 x 0.98 Open Price is within Open Qte Tick Worse Qte does not lock/cross Open Prc Tick Worse Qte = B@0.95	Example 2: Tick Worse Qte = S@0.97 Open Price = 0.96 Open Qte = 0.95 x 0.98 Open Price is within Open Qte Tick Worse Qte does not Lock/Cross Open Prc Tick Worse Qte = S@0.97

Opening price is At or Outside the opening quote BBO

- If the last opening price is outside the same side opening quote BBO, then adjust the tick worse quote to join same side BBO quote.

  The following examples illustrate this concept:

Example 1: Tick Worse Qte = B@0.98 Open Price = 0.94 Open Qte = 0.95 x 0.98 Open Price is outside same side Open Qte Adjusted Tick Worse Qte to same side BBO = B@0.95	Example 2: Tick Worse Qte = S@0.96 Open Price = 0.99 Open Qte = 0.95 x 0.98 Open Price is outside same side Open Qte Adjusted Tick Worse Qte to same side BBO = S@0.98
Example 3: Tick Worse Qte = B@0.98 Open Price = 0.95 Open Qte = 0.95 x 0.98	Example 4: Tick Worse Qte = S@0.96 Open Price = 0.98 Open Qte = 0.95 x 0.98

Open Price is at the same side Open Qte Adjusted Tick Worse Qte to same side BBO = B@0.95	Open Price is at the same side Open Qte Adjusted Tick Worse Qte to same side BBO = S@0.98

- If the last opening price is NOT outside the same side opening quote BBO, and if the tick worse quote is locked or crossed with the opposite side BBO, then adjust the tick worse quote to be 1 tick inferior to the opposite side BBO. If the opposite side BBO is not locked or crossed, then use the tick worse quote.

  The following examples illustrate this concept:

Example 1: Tick Worse Qte = B@0.98 Open Price = 0.99 Open Qte = 0.95 x 0.98 Open Price is outside opposite side Open Qte Adjusted Tick Worse Qte uncrossed from opposite side BBO = B@0.97	Example 2: Tick Worse Qte = S@0.95 Open Price = 0.94 Open Qte = 0.95 x 0.98 Open Price is outside opposite side Open Qte Adjusted Tick Worse Qte uncrossed from opposite side BBO = S@0.96
Example 3: Tick Worse Qte = B@0.96 Open Price = 0.99 Open Qte = 0.95 x 0.98 Open Price is outside opposite side Open Qte Tick Worse Qte = B@0.96	Example 4: Tick Worse Qte = S@0.96 Open Price = 0.94 Open Qte = 0.95 x 0.98 Open Price is outside opposite side Open Qte Tick Worse Qte = S@0.96

- Note if at any time the tick worse causes the price to move outside globally allowable prices (ie, <= 0 or > the configurable Max Price), the new quote is not put on the book as done during regular trading.

  The following examples illustrates when this can occur:

Example 1: Tick worse price = 0.01 Open price = 0.01 Open Qte = 0 x 0.01 Bid side uncross from opening price which is at min tick	Example 2: Tick worse price = 0.01 Open price = 0.02 Open Qte = 0 x 0.01 Bid side uncross from opposite side where offer price is at min tick
Example 3:	

Tick worse price = 99,999.9999 Open price = 99,999.9999 Open Qte = 0 x 0 Offer side uncross from max	

The following process flow illustrates the modified tick worse behavior

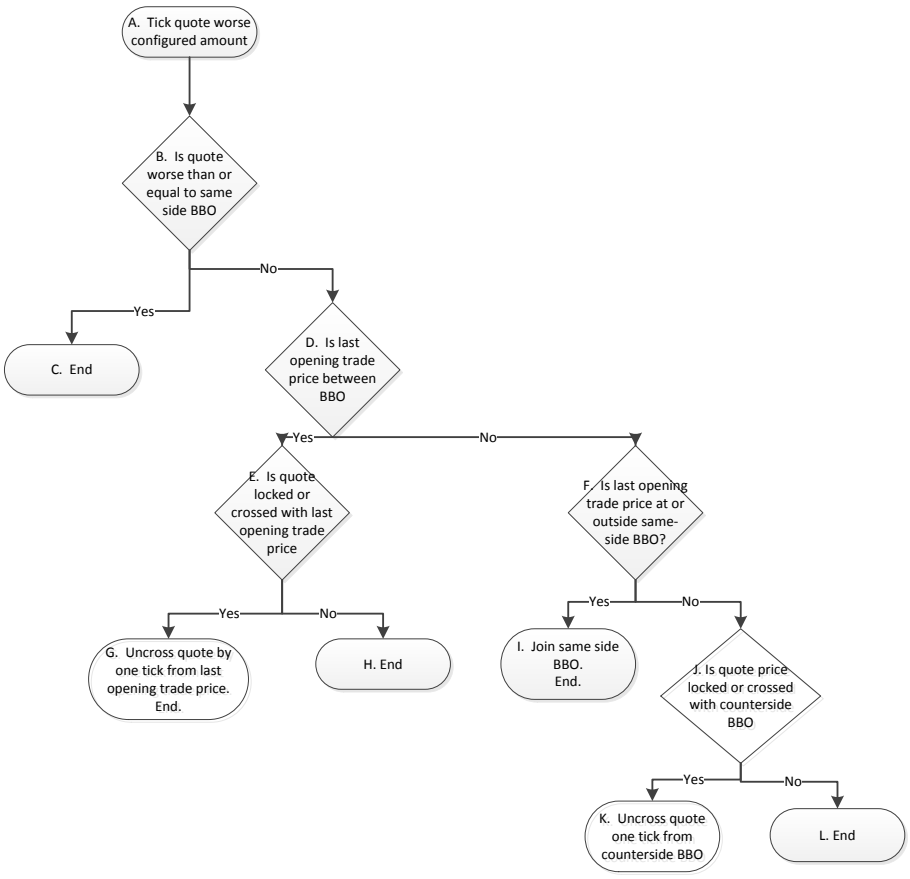

Figure 10: Opening Tick Worse Behavior

3.5.8 Weighted Average

The weighted average functionality is currently not configured to be used, nor will it be used for the new opening process, therefore can be de-commissioned.

3.5.9 Additional Functionality to be Retired

For the determination of the boundary prices, the following product parameters from the reference database can also be de-commissioned.

- *OpeningWAMin*
- *openingWAFlag*
- *openingPriceAdjustmentPct*
- *IgnoreBoundaryPrices*

3.5.10 Sell Market Order Conversion

If the bid-side boundary is one tick or less (could be zero), and the ask side best price is less than or equal to $0.40, and there is more sell market order quantity than bid quantity, then market orders are converted to limit orders for 1 tick, and the opening price is recalculated without boundaries. Note this behaviour will be removed with the new opening, and addition of 3-tick lock and market order lock will provide protections for market orders. Reference the order protection in sections for Iteration 1 and Iteration 2.

3.6 Major Steps in the Opening Rotation

1. For Iteration 1:
   - Determine boundary prices including consideration of the ABBO (see Section 3.5.2.1.

Check whether a valid opening price can be found (see Section 3.5.1). If not, the instrument will remain in Opening state, and the procedure will end.
Match orders and quotes at the Iteration 1 opening price without refreshing the displayed quantity of the matched Reserve Orders (see Section3.6.2).
Protect and remove orders as needed (see Section3.5.2.5)

2. If there are marketable orders and quotes after Iteration 1 completes, start a second iteration:
   - Widen the boundaries and then attempt to find an opening price (see Section 3.5.3.1).

Match orders and quotes at the Iteration 2 opening price, and protect and remove orders as needed.

3. If marketable interest remains after Iteration 2, initiate a third iteration (see Section 3.5.4). For Iteration 3:
   - Determine a new opening price.

Allocate trades accordingly.

4. If marketable interest remains after Iteration 3, initiate a fourth iteration (see Section 3.5.5)
   - Determine a new opening price without boundaries (see Section 3.5.5.1).

Allocate trades accordingly (see Section 3.5.5.2).

5. Cancel remaining quantities of the Opening Only orders.
6. Set the instrument state to “regular”. (This will trigger the Market Data Distributor to send out the BBO with the Opening Price.)[DFS3510-00753]
7. Trigger stop orders (see Section 7.1 in the latest DFS for details). Triggered stop orders can match against the remaining hidden quantities of Reserve Orders and AON and MEQ orders but without refreshing the displayed quantity of the matched Reserve Orders with a buy (sell) price greater (smaller) or equal than the opening price.[DFS3510-00754]
8. Feed all MEQ and AON orders (See cross reference to be provided to MEQ in Opening section which will either be in this doc or the DFS). Stop orders are triggered each time after one order has been fed. Note the

displayed quantity of a matched Reserve Order during this step is not refreshed if its buy (sell) limit price is greater (smaller) than or equal to the opening price. [DFS3510-00756]

9. Feed all buy Reserve Orders from the highest price down to the opening price (included) and afterwards all sell Reserve Orders from the lowest price up to the opening price (included) into the market following the rules for incoming Reserve Orders (see Section 3.6.2 in the DFS or the section in the BRD that covers this). Stop orders are triggered each time after one order has been fed. The display quantity of the fed order is systematically refreshed before the stop order triggering is checked. But the displayed quantity of a matched Reserve Order on the opposite side is not refreshed if its buy (sell) limit price is greater (smaller) than or equal to the opening price.[DFS3510-00755]
10. Start accepting new transactions for continuous matching.[DFS3510-00757]

3.6.1 MEQ Participation in the Opening Rotation

MEQ orders do not participate in the opening uncrossing rotation. It might be that the prices of several buy (sell) contingent orders are greater (smaller) or equal to the opening price, creating a potentially crossed IBBO after the opening uncrossing. Thus to provide the opportunity to match the potentially crossed contingent orders on the book, the matching engine feeds them as incoming orders directly after the stop orders are triggered and before Reserve Orders are fed (See Section 3.6 “Major Steps in the Opening Rotation”). During this phase, the MEQ triggering is not checked.

The feeding of the MEQ orders starts with the buy side, using the orders with the highest prices. If there were two or more MEQ orders at the same price, the system would process the oldest two first. When all the buy orders are processed, the feeding continues with the MEQ orders on the sell side, using the order with the lowest price and the oldest time priority stamps.

Like in continuous trading, if the feeding of a MEQ order results in a match event, then the stop order triggering is checked immediately after. If some new stop orders are triggered and saved on the book, then the buy or the sell MEQ triggering limit prices are updated. In this case, a final MEQ triggering is done at the end of the MEQ order feeding.

3.6.1.1 Trade Price Restrictions for Contingent Orders

AON and MEQ orders are processed together without distinction and they can only be executed at or within the IBBO and at a price not worse than the ABBO on the opposite side.

The trade price of a contingent order on the book must be better than the IBBO on the opposite side. When the hidden buy (sell) contingent orders have a price greater (smaller) or equal to the IBBO sell (buy) price, then the trade price is one tick smaller (greater) than the IBBO sell(buy) price.

When the IBBO spread is only one tick, then the hidden buy (sell) contingent orders which have a price greater (smaller) than the IBBO sell (buy) price will match only after the orders at the IBBO sell (buy) price. However, since the price of these hidden orders was better than the IBBO on the opposite side, they are executed by price priority before the other contingent orders at the IBBO price.

Example

The opening price is 91 (all buy and sell orders and quotes at this price are matched).

Two quotes (from 2 different market makers) tick-worse with quantity 10 (buy @ 90 and sell @ 92).

The new IBBO is: **10 @ 90 / 10 @ 92**

We have the following 5 hidden (crossed) AON orders:

- 10 buy @ 93 AON

- 10 buy @ 91 AON
- 10 Sell @ 88 AON
- 10 Sell @ 89 AON
- 10 Sell @ 90 AON

Like for Reserve Orders, the feeding starts with the buy AON orders.

- The buy 10 @ 93 could be matched against the sell AON order 10 @ 88.
- The buy 10 @ 91 could be matched against the sell AON order 10 @ 89.

However the trade prices of 88 and 89 are not valid since they are outside the IBBO which is 90 / 92. In the same way, we can not match the incoming buy AON orders at 90 because the priority of the buy quote would not be respected.

Finally both buy AON orders are matched at one tick better than the buy IBBO, than means 91 (which is also the opening price of our example but it is not always true).

At the end the remaining 10 Sell at 90 AON is executed against the buy side of the IBBO (the tick worse buy quote at 90).

Just as hidden contingent orders must trade within the display IBBO that is maintained internally by the Matching Engine, triggered Stop Orders, Reserve Orders, AON and MEQ orders must trade at or within the ABBO during the opening rotation.

When buy (sell) triggered stop orders or fed Reserve Orders try to match at a price greater (smaller) than the NBBO offer (bid) price, then the execution is stopped and the away market handling applies for the remaining unmatched quantity (see DTS Section **14 Away Market**).A Flash Order auction is started for both customer orders and non customer orders.

Note: Currently Stop orders are only allowed for customer client categories, but Reserve Orders can also be entered for non-customer client categories. In this case, it might be that the Away Market handling deletes the unexecuted balance of these non customer Reserve Orders after the Flash auction.

When buy (sell) fed AON or MEQ orders try to match at a price greater than the NBBO offer (bid) price, then they do not match and they stay hidden on the book. In case of a MEQ order for which the minimum execution quantity can be executed at or inside the ABBO, it is executed till the ABBO price on the opposite side and the remaining unmatched quantity stays on the book.

3.6.2 Reserve Order Handling in the Opening Rotation

During the opening rotation Reserve Orders require the following considerations regarding Display and Hidden Quantity:

- Only the display quantity of Reserve Orders is used for the determination of the opening price. During the opening uncrossing only the display quantity of Reserve Orders is matched without being immediately refreshed from the hidden quantity.
- If in the new opening, Reserve Orders have their display quantity fully traded, they will not be flashed until after they are fed. Note this means such orders will not benefit from the new opening 3-tick protection, however once in a regular trading state and the order is fed, they are subject to regular protections as done during normal trading.
- If in the new opening, Reserve Orders do not fully trade their display quantity, they will be flashed at the end of the opening, before they are fed.

- The hidden quantity of the buy (sell) Reserve Orders which have a price greater (smaller) or equal than the opening price do not participate to the uncrossing, because they could create a crossed market situation. That is why they will be fed against the market towards the end of the uncrossing procedure. Note only Reserve Orders that have their entire display quantity traded out are fed.

Reserve Orders also require the following considerations when feeding orders:

- At the end of the opening rotation after the AON and the MEQ orders have been fed, the opening crossed Reserve Orders are fed into the market. They are individually processed like incoming orders with the hidden quantity plus the display quantity as incoming quantity.
- The feeding concerns all Reserve Orders which have a price better or equal than the opening price (greater or equal for the buy Reserve Orders and smaller or equal for the sell Reserve Orders). All opening crossed Reserve Orders are considered independently whether they have participated in the opening rotation or not.
- The feeding starts with the buy Reserve Orders, starting with Reserve Orders with the highest prices down to the opening price (included). If there were two or more buy Reserve Orders at the same price, the system would feed customer orders first in time priority (depending on the ***custPriorityFlag***) and then non-customer orders in time priority.
- When all buy Reserve Orders are processed the feeding continues with the sell Reserve Orders, starting with Reserve Orders with the lowest prices up to the opening price (included). If there were two or more sell Reserve Orders at the same price, the system would feed customer orders first in time priority (depending on the ***custPriorityFlag***) and then non-customer orders in time priority.
- The full (remaining) quantity of Reserve Orders (display and hidden quantities) is considered during the feeding. After the feeding, the display quantity of each fed Reserve Order is refreshed. The display quantity is systematically recalculated according to the refresh attribute DisplayMethod. Which means Reserve Orders with refresh set to immediate will not refresh in between iterations.

Additional considerations for Reserve Orders:

- The hidden quantities of Reserve Order on the book are executed against the fed Reserve Orders and eventually the triggered stop orders with a price at or inside the IBBO.
- After each Reserve Order feeding resulting in a match, the triggering of stop orders is checked.
- When some hidden quantities of Reserve Order on the book are matched during the feeding of AON or MEQ orders, a Reserve Order, or eventually during the matching of a triggered stop order, the display quantity is refreshed only for buy (sell) orders which have a price smaller (greater) than the opening price. The display quantity of other Reserve Orders crossed with the opening price is refreshed only by the Reserve Order feeding.
- Note that since the instrument is now in Regular fed reserve orders receive normal ABBO protection; i.e. the Away Market is considered when matching, and customer Reserve Orders may be exposed in a Flash Order auction before being locked with the AMB lock. Non-customer Reserve Orders may also be exposed in a Flash auction, and any remaining unexecuted quantity after the Flash auction will be cancelled.

3.7 Complex Instruments Opening

Currently standard complex instruments are opened with synthetic ABBOs and synthetic ISE BBO in a similar manner as simple instruments with synthetic BBOs as boundary prices. Since there is no PMM/CMM quote

boundary, no change is expected in boundary calculation process and opening price determination process. However today if the preliminary opening price is outside the boundary and there is an overlap with the boundary; the opening process is stopped and the order book is uncrossed by feeding orders. Going forward if such situation arises, the opening price will be adjusted to the boundary price(s) and opening trades will be executed at or within the boundary before the feeding process is started.

The following examples illustrate when the opening price is adjusted to the boundary price; i.e. POP is outside the boundary and there is an overlap of tradable prices with the boundary price:

Example 1:	Example 2:
Boundary = 1.00 x 1.05	Boundary = 1.00 x 1.05
Combo O1 Sell@0.98	Combo O1 Sell@0.98
Combo O2 Buy@1.02	Combo O2 Buy@0.98
POP = 0.98	POP = 1.00
Old opening does not open and uncrossing is done by feeding combo orders.	Old opening does not open and uncrossing is done by feeding combo orders.
New opening the POP is adjusted to boundary price.	Future O2 is not part of the POP b/c like simple instruments the AQF only includes valid interest.

Another difference will be the use of new parameters to support random allocation in complex instruments. The Exchange currently designates on a class basis whether bids and offers at the same price are executed: (i) in time priority; (ii) pro-rata based on size after all Priority Customer orders at the same price are executed in full; or (iii) pro-rate based on size. The Exchange proposes to modify the opening process with respect to bids and offers at the same price. As proposed, in symbols where the allocation is set to price-time; all orders and quotes with the same limit price will be executed in random order. In symbols where the allocation is set to pro-rata with customer priority; Priority Customers will continue to be given priority over Professional Orders and quotes. Priority Customer orders with the same limit price, however, will be executed in random order. Professional Orders and quotes with the same limit price will continue to be executed pro-rata based on size. The Exchange does not propose to change the allocation in symbols where the allocation is set to pro-rata based on size.

The new parameters are expected to be set as follows in standard complex instruments. Also see configuration and Reference Data details in the next section.

- Non-Quoted Symbols:
  - custPriorityAtOpen = Off
  - GeneralAllocationAtOpen = Random
  - custAllocationAtOpen is Not Applicable as Customer priority is turned off
- Quoted Symbols:
  - custPriorityAtOpen = On
  - GeneralAllocationAtOpen = Pro-Rata
  - Allocation within customers = Random
  - These parameters will be kept independent of each other.

Note although parameters will be available for stock combos, they will not be used, as there is no opening process for this instrument type, therefore the settings must be initialized accordingly.

3.8 Reference Data & Configuration Support

Following sections describe the necessary business controls and the supporting database parameters to manage rollout of the new opening functionality.

3.8.1 Required Business controls

- The ability to turn on or off the new opening process will be required on the market model level to support configuration on a product-instrument type basis to control rollout and rule filing dependency.
- Allocation must be controllable to use pro-rata, price time, or random.
- Rollout of Simple and Complex instruments for the same product must be independent; i.e. either the old opening algorithm will apply or the new opening algorithm will apply to simple instruments or complex instruments.

The following table illustrates the intended business use of the configurations:

Scenarios					
Product	**Instrument Type**	**Opening Algo**	**Customer Priority At Open**	**Customer Allocation**	**General Allocation**
IBM	Simple	Old	n/a	Price Time	Pro Rata
(Unquoted Complex)	Combo	Old	n/a	n/a - No Cust Priority	Price/Time
GOOG	Simple	New	New – on	Random	Pro-Rata
(Unquoted Complex)	Combo	New	New – off	n/a - No Cust Priority	Random
GLD	Simple	New	New – on	Random	Pro-Rata
(Quoted Complex)	Combo	New	New – on	Random	Pro-Rata
XOP	Simple	Old	n/a	Price Time	Pro Rata
(Quoted Complex)	Combo	Old	n/a	Price Time	Pro Rata

The following table illustrates the intended business settings per Reference Data:

Ref Data Settings				
Product	**New Open Algo**	**custPriorityAtOpen**	**custAllocationAtOpen**	**generalAllocationAtOpen**

IBM	FALSE	n/a	n/a	n/a
(Unquoted Complex)	FALSE	n/a	n/a	n/a
GOOG	TRUE	TRUE	3-Random	2-Pro Rata
(Unquoted Complex)	TRUE	FALSE	n/a	1- Price/Time
GLD	TRUE	TRUE	3-Random	2-Pro Rata
(Quoted Complex)	TRUE	TRUE	3-Random	2-Pro Rata
XOP	FALSE	n/a	n/a	n/a
(Quoted Complex)	FALSE	n/a	n/a	n/a

Note, although the illustrations above shows combos with "True" or "New" Opening Algo applied in line with intended business use; pending rule approval of Combo Opening changes, the "Old" Opening Algo or "FASLE" will be used for day one, reference the Day One Configuration guide. New Open Algo will be configurable on the market model level, which will allow for simple instruments in a product to be enabled for the new opening, while the complex instruments in the same product continue to use the legacy opening functionality.

3.8.2 Reference Data

Reference Data will need two new sets of controls. One parameter to turn on or off the application of the new opening process, on a market model level (allowing for configuration per product and instrument type), and another to support which allocation priority to apply during the new opening process.

Default will be current production behavior, i.e. the parameter setting will need to be set in order to invoke the new opening process. If the new opening process is set to be active, then the allocation priority within the new opening process must also be set.

Design is left to the discretion of the Development team, below only provides the overview of the required concept.

NewOpenAlgo	On/Off (controllable at the market model level)
	On = new opening process is active
	Off = current production opening process

Below configurations are only applicable if above parameter is set to On, controllable at the Market Model/product-instrument type level.

custPriorityAtOpen	On/Off
	On = new opening process is active
	Off = current production opening process
GeneralAllocationAtOpen	1/2/3
	1 = Price/Time

	2= Pro-Rata
	3 = Random
custAllocationAtOpen	1/2/3
	1 = Price/Time
	2= Pro-Rata
	3 = Random

Note with the early introduction of the above parameters, the default does not have the new opening algorithm active. Therefore the allocation parameters are not applicable. However *GeneralAllocationAtOpen* and *custAllocationAtOpen* are defaulted with "1 = Price/Time". Rollout will require operational changes to align these settings as per business scenarios described in section **Error! Reference source not found.**~~3.7.1~~

3.8.3 RDC

The following new fields should be added to the MatcherMarketModelParameters View

1. NewOpenAlgo
2. custPriorityAtOpen
3. generalAllocationAtOpen
4. custAllocationAtOpen

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~~3.8~~3.9 Market Data

The MDI supports communication of the opening price in both the TOB ticker and Ticker Binary feeds. With the introduction of a multiple price open there can be more than one price at the open, however MDD will maintain current functionality, in disseminating the first trade price as the "Opening price for the day".

~~3.9~~3.10 Maker Taker

With multiple price open, there can be more than one trade, in which case Maker Taker value identified as open will apply to all opening executions.

Chapter 4 Non-Functional Requirements

4.1 Operational Deployment

Rollout and configuration reference the Day 1 Document.

4.2 Documentation

Updates are required to supporting documentation for all impacted applications.

4.3 Acceptance Criteria

Functional and regression certification required.

4.4 Performance Acceptance

Performance impact should be assessed.

4.5 Rules

Rule change required.

Chapter 5 Future Considerations

5.1 ROM

- ROM – DFS Section 4.3.1.9
  - Consider removing ROM condition for MMBBO. Reference Production Matcher DFS Part A, 2nd bullet.
    - The MMBBO (quote only BBO) is not crossed by more than a configurable number of ticks (specified by the *autoOpenMaxNumMMBBOCrossTicks* general Matching Engine parameter).[DFS3510-00099]
  - Consider removing ROM condition for ABBO. Reference Production Matcher DFS Part A, 3rd bullet.
    - Instruments belonging to the product receive ABBO updates (specified by the *receivesABBOUpdates* market model parameter) and the ABBO has a valid sell side quote.[DFS3510-00100]

5.2 Additional use of the ABBO

- Section 3.4 consider not waiting for acting PMM quote if their auto rotate flag is set. Consider using ABBO as trigger for open.
- Section **Error! Reference source not found.**Removed handling of market orders in the absence of a boundary price using the ABBO. Note this principal can apply with limit orders as well. Decided to simplify the implementation and move to future consideration. For reference, below is the original requirement.

Another difference is handling of the condition where only market orders are available on both sides. Today the instrument is set into an imbalance state. Note this can occur when the PMM quote has curtailed during the opening process and ISE has no other CMM quote available to use as the boundary, or when ROM has initiated the open. The handling of this condition with new logic will be as follows:

- If there is an ABBO available, a boundary price was calculated in step 1 and the opening price is set to the midpoint of the boundary prices. Note if the midpoint is between ticks, round down as done in current trading procedure. Note this applies regardless if quantities are even.
- If there is 0 bid or 0 offer on the ABBO the priority customer orders on the opposite side of 0 prices are locked to the PMM and non-customer market orders are cancelled while the side with bid / offer on the ABBO are flashed/routed out as in normal trading procedure. The market will be opened with 0 x 0 prices. Note in the event there is no PMM to lock to, orders will be cancelled as in regular market trading.
  a. If there is 0 bid with no offer available on ABBO, then the buy market order will be flashed and AMB locked/cancelled. And sell market order will be market order locked to PMM/cancelled.
  b. If there is 0 offer with no bid on ABBO, then sell market order will be flashed. And buy market order will be market order locked to PMM/cancelled.
- Note if there is no bid on the ISE BBO, it is still considered as no boundary price bid as opposed to using lowest tick as the boundary prices.

The following examples illustrate final price determination when only market orders are present on both sides:

Example 1: FOP = Midpoint of ABBO	Example 2: FOP = n/a

	ABBO 1.00 x 1.10 PMM curtailed Ord1 B10@mkt Ord2 S10@mkt Final Open Price = 1.05	ABBO 0 x 1.10 PMM curtailed Ord1 B10@mkt Ord2 S10@mkt Ord1 flashed/amb locked Ord2 mkt ord lock to PMM Final Open Price = n/a Open 0 x 0

5.3 Inverted Optimization

- Section **Error! Reference source not found.**can be further optimized to keep tradable interest at the ISE instead of locking and routing away. The following examples illustrate when this can be considered.

Example 1: Away Bid & Offer inverted ABBO 1.05 x 1.00 IBBO 0.95 x 1.10 Ord1 B100@mkt Ord2 S100@mkt Sell Order interest can trade between 1.05 and 1.10. Buy Order interest can trade between 0.95 and 1.00. Current design will lock both buy and sell orders due to better away inverted prices.	**Example 2**: Away Bid & Offer Inverted and ISE Offer Locked ABBO 1.05 x 0.95 IBBO 1.00 x 1.05 Qte2 B5@1.05 Ord1 S10@1.05 Sell Order interest can trade at 1.05, before locking/flashing.

Addressed using effective price orders.

5.4 Adjust Minor Inverted Inconsistency

- Section **Error! Reference source not found.**During inverted market; orders behavior is defined with regard to following the ABBO in iteration 1, then removal of the PMM boundary. However if there were ONLY quotes during the inverted market, we use the PMM boundary which is inconsistent with iteration 2 behavior for quotes. See examples below:

Example 1: ABBO 1.05 x 1.00 PMM 0.95 x 1.10 Qte1 S10@0.90 Since there are no oterds, current design will adjust opening trade to PMM Boundary 10@0.95	**Example 2**: ABBO 1.05 x 1.00 PMM 0.95 x 1.10 Ord1 S10@mkt Qte1 S10@0.90 Current design will flash AMB lock Ord1, then in iteration 2 there is no boundary and Qte1 trades with the PMM @0.90

5.5 Adjust Random Allocation to more equitable algorithm

- Reference Section **Error! Reference source not found.**regarding new allocation method.
- In an effort to avoid SEC rule process delay, the random allocation algorithm was targeted.
- During reviews, discussion of the new "random" allocation highlighted an odd implication. The way it is currently specced results in a set of extreme winners and extreme losers. For example:

Order1 Buy 10@1 Order2 Buy 10@1 Order3 Buy 10@1 Order4 Buy 10@1 Order5 Buy 10@1 Sell 25@1
As specced, we randomly sort Orders 1-5, and then trade, like so: Order3 Buy 10@1 Order5 Buy 10@1 Order2 Buy 10@1 Order1 Buy 10@1 Order4 Buy 10@1 Orders 3 and 5 trade in full, Order 2 trades half, and Order 1 and 4 get nothing.

- Recall that the impetus for this new algo was to not prioritize "very old" gtcs over "old" gtcs over today's day orders, or 9:00 orders over 9:01 orders. Thus, it seems that an algo resulting in a more equitable distribution would align better with our goals. Something like trying to distribute the smaller size evenly, and redistributing any spillover to larger orders. Like so:

Order1 Buy 10@1 Order2 Buy 2@1 Order3 Buy 10@1 Order4 Buy 10@1 Order5 Buy 18@1 Sell 25@1
25 qty / 5 orders = 5 per order. Because order2 has only a quantity of 2, the extra 3 are redistributed (as best as possible) amongst orders 1, 3, 4, and 5. The actual algo looks like this:
Divide larger side total open quantity by number of orders/quotes left to trade. Round down. Trade next smallest untraded (ties can go random) order/quote the lesser of its open quantity and the number calculated in step 1. Goto 1.
Walking through the example: 25 / 5 = 5. Order 2 trades 2. 23 remain. 23 / 4 = 5.75 ~ 5 Order 1 trades 5. 18 remain. 18 / 3 = 6. Order 3 trades 6. 12 remain. 12 / 2 = 6. Order 4 trades 6. 6 remain. 6 / 1 = 6. Order 5 trades 6. 0 remain.

- Note user could potentially game this algorithm if they were to divide a large order into a bunch of smaller orders, This may be unlikely with GTCs, however possible pre-market orders. In order to mitigate, orders can be grouped by BUs and divided by the the number of BUs instead of number of orders. Additional note pattern and practice of splitting orders is a violation of rules, and can be handled as a surveillance practice.

5.6 Enhanced Non-customer protection

There is a potential gap in the extent of protection for non-customers. Using the Goldman incident when they flooded the market with mispriced orders as an example; our current open provided some level of protection, which we want to preserve.

Future consideration should balance how much protection to provide. Reference example below that highlights this.

In the example below we will open 0.89 x 0.90…while the ABBO is 0.99 bid, in which case Goldman could likely be traded out on their mispriced order. So in the future we would look to find the right balance between grossly mispriced vs ok to be somewhat mispriced.

ABBO 0.99 x 1.15

PMM 0.89 x 1@1.15

Sell 10@0.90

Possible solution to consider:

Prevent the opening with non-customer orders resting too “deeply” through the away market.

Potentially add an extra check at the end of everything. Delete any remaining orders that are X ticks through the away market, regardless of what went on before/during the opening.

Appendix A. Excel Macro for AQF

An Excel macro, available in the T7 Release 9 DTS folder, allows users to input an opening scenario for an instrument and graph the accumulated quantity function. Users can input buy and sell side orders and quotes, click the Graph button, and view the buy and sell side step functions.

The graphed step functions illustrate how the POP is determined. Figure 1, below, is the output from the Excel macro based on sample scenario data shown. The intersection of the two step functions represents the POP level.

- If there is one price level at the step function intersection, that price level is the POP.
- If there is more than one price level where the step functions intersect, the matching engine calculates the arithmetic mean from the price levels at the intersection and designates the mean as the POP.

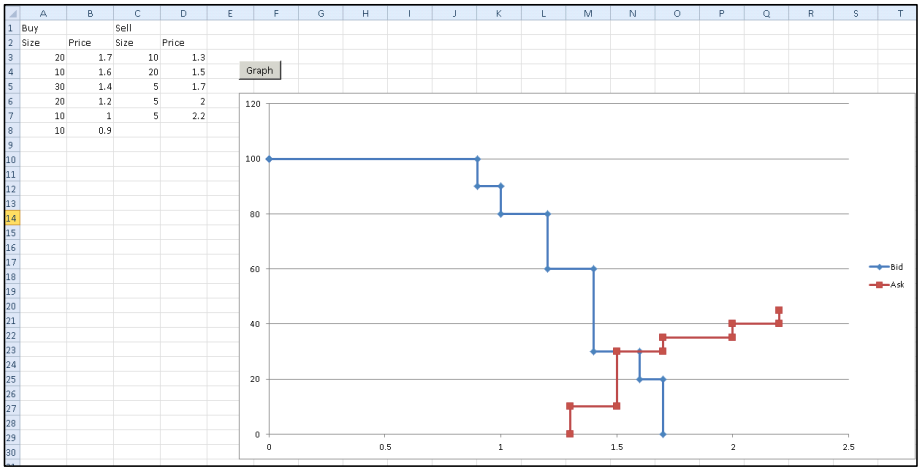


Figure 11: Accumulated Quantity Function Excel Macro

NOTE: The matching engine automatically treats all market orders as limit orders before running the AQF. In the Excel sheet, however, the user must manually do this. In the Figure 1 scenario, this has already been done.

Examining the graph in Figure 1 is instructive for understanding how the function works. Note that:

- The Y axis representa accumulated quantity. The X axis represents price.
- In the Excel sheet, the exact data for each point are provided via mouse hover over the point.
- The blue line represents the bid side monotonically falling step function. Start reading the points on the blue bid side line at quantity 100.
    - The first point (P0) represents the accumulated quantity of the buy orders and quotes that could execute at a price of 0.9 (all orders and quotes in the scenario could execute at this price). The first point on the bid side graph starts at the maximum executable quantity.
    - The second point (P1) represents the accumulated quantity of the buy orders and quotes that could execute at the next price level in the scenario bid data. Note that the blue line drops to the next calculated accumulated quantity level, and moves horizontally to the right to the price level for that accumulated quantity. This point is P1, as shown in Figure 2.

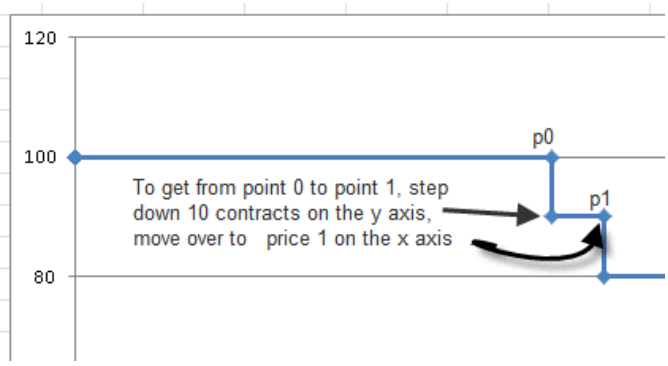


Figure 12: Bid Points on the AQF

- The reset of the bid side points on are similarly derived.

- The red line represents the ask side monotonically rising step function. Start reading the points on the red ask side line at quantity 0.
  - The first point (P0) always starts at 0 quantity and the lowest ask price level. This point establishes the lowest ask price.
  - The next point (P1) rises to the quantity level that represents the accumulated quantity of sell orders and quotes that could execute at this price level.
  - The next point (P2) moves horizontally to the next price level, and rises to the accumulated quantity of sell orders and quotes that could execute at this price level.

    Continue until all sell price levels have been analyzed analyzed.

- The intersection of the bid and ask graphsidentifies the Preliminary Opening Price. In Figure 1, note that there is more than one price level where the bid and ask graphs intersect. In such cases, the AQF calculates the arithmetic mean of the price levels at the intersection. In The following figure, the overlapping points are at 1.5 and 1.6. The Preliminary Opening Price is the arithmetic mean of these two price levels, or 1.55.

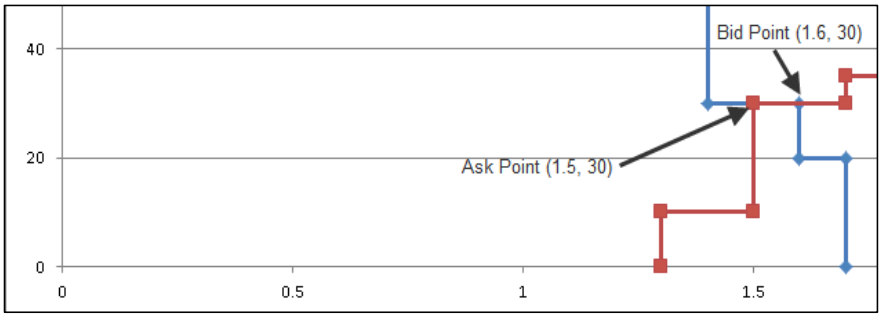


Figure 13: POP When AQF Identifies Multiple Price Levels

Appendix B. Examples

The following detailed opening examples are provided in this Appendix. The examples below consider orders to be priority customer to highlight order protection principles related to ABBO, Mkt Order Lock, and 3-tick Lock

Example 1	PMM Boundary, No ABBO, and Market order lock
Example 2	PMM Boundary, No ABBO, and 3-Tick lock
Example 3	PMM Boundary is considered 1st
Example 4	ABBO Boundary is considered 1st
Example 5	PMM and ABBO Locked Boundary Price

The following detailed opening example consider orders to be non-customer to highlight principles related to non-customer 3-tick protection, and need for the fourth iteration.

Example 6	PMM and ABBO, one side inverted

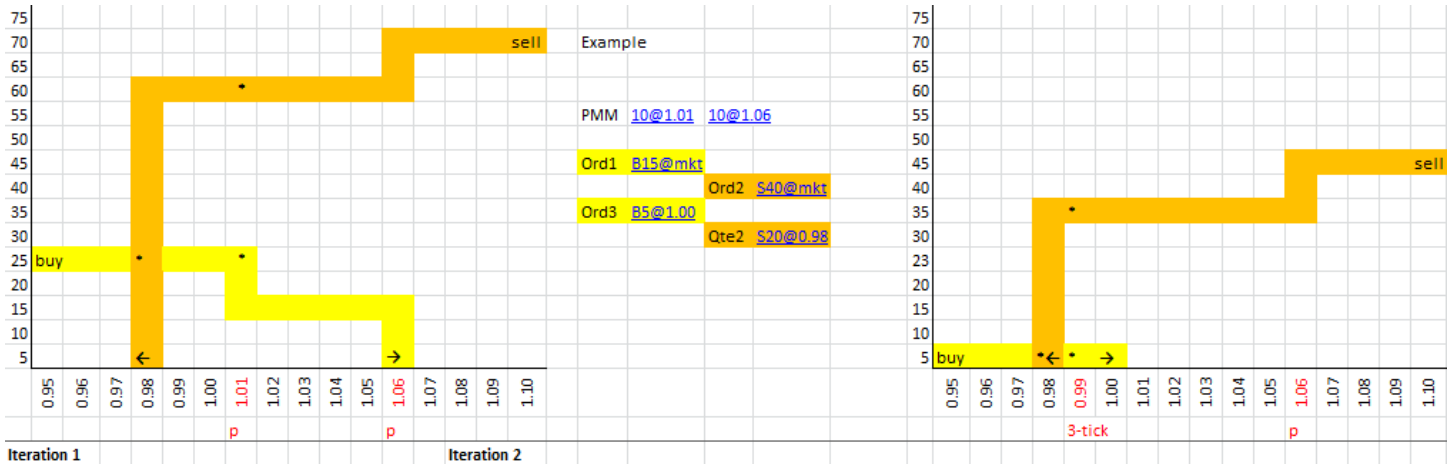
The following detailed opening example highlights the inverted market principle, and considers orders to be Priority Customer to highlight the use of effective price and order protection principle.

Example 7	ABBO, both sides inverted

The following abbreviations are used:

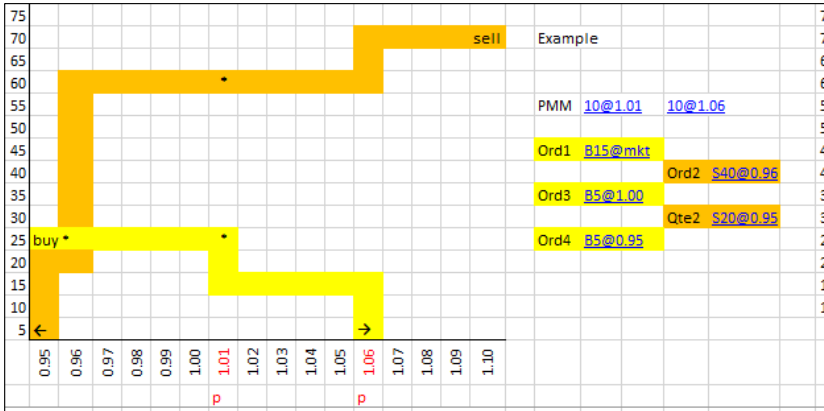
B	Boundary Price
POP	Preliminary Open Price
FOP	Final Open Price
T&A	Trade and Allocation
OP	Order Protection
EP	Effective Price

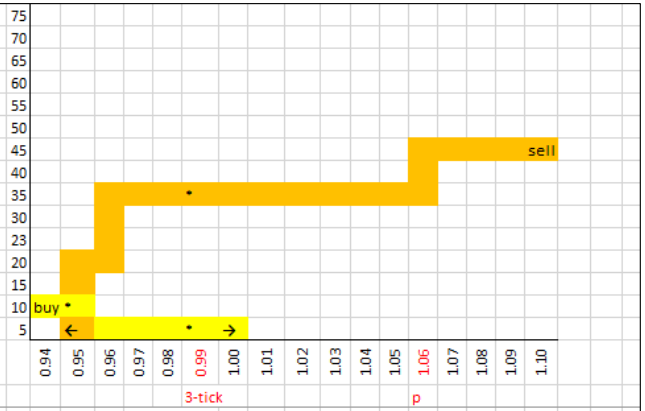
B.1. Example 1. PMM Boundary, No ABBO, and Market Order Lock



Iteration 1					Iteration 2				
B	PMM	B10@1.01			B	3-tick	0@0.99	rmv pmm b10@1.01	
	PMM	S10@1.06				PMM	S10@1.06	sell side hasn't been used so don't remove	
POP		25@0.98	AQF w/ valid interest		POP		5@0.98	AQF w/ valid interest	
FOP	adj	25@1.01	pmm boundary		FOP	adj	5@0.99	3-tick boundary	
			note POP adj price					note POP adj price	
T&A	PMM	B10@1.01			T&A	Ord3	B5@0.99		
	Ord1	B15@1.01				Ord2	S5@0.99	lvs	S10@mkt
	Ord2	S25@1.01	lvs	S15@mkt		Qte2		lvs	S20@0.98
	Ord3		lvs	B5@1.00		PMM		lvs	S10@1.06
	Qte2		lvs	S20@0.98					
	PMM		lvs	S10@1.06	OP	Ord2	S10@mkt	mkt ord lock	
								convert balance to lowest tick	
OP	no orders lock/cross ABBO					orderbook is no longer crossed			
						post best bid/ask			
	orderbook crossed start iteration 2					Qte2	S20@0.98		

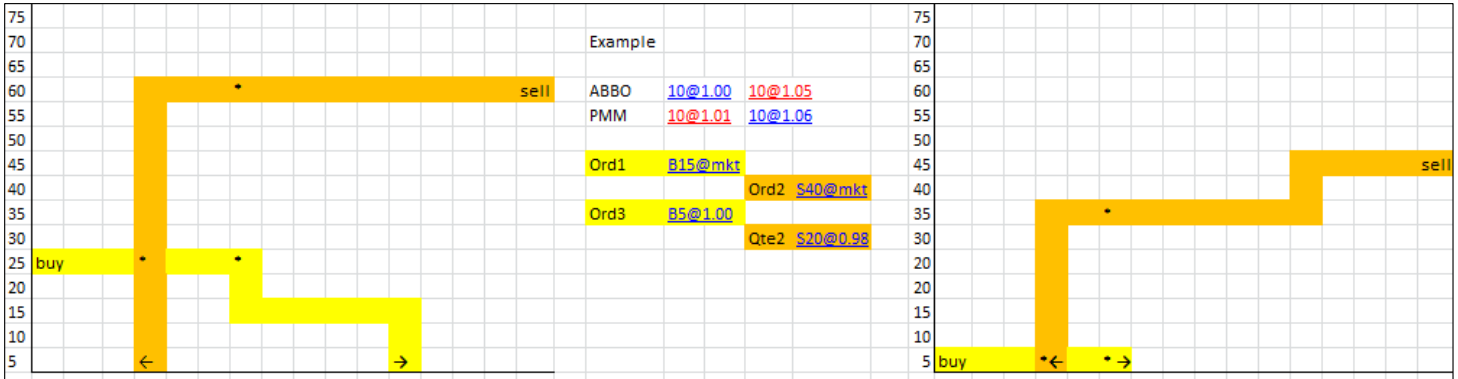
B.2. Example 2. PMM Boundary, No ABBO, and Three-Tick Lock





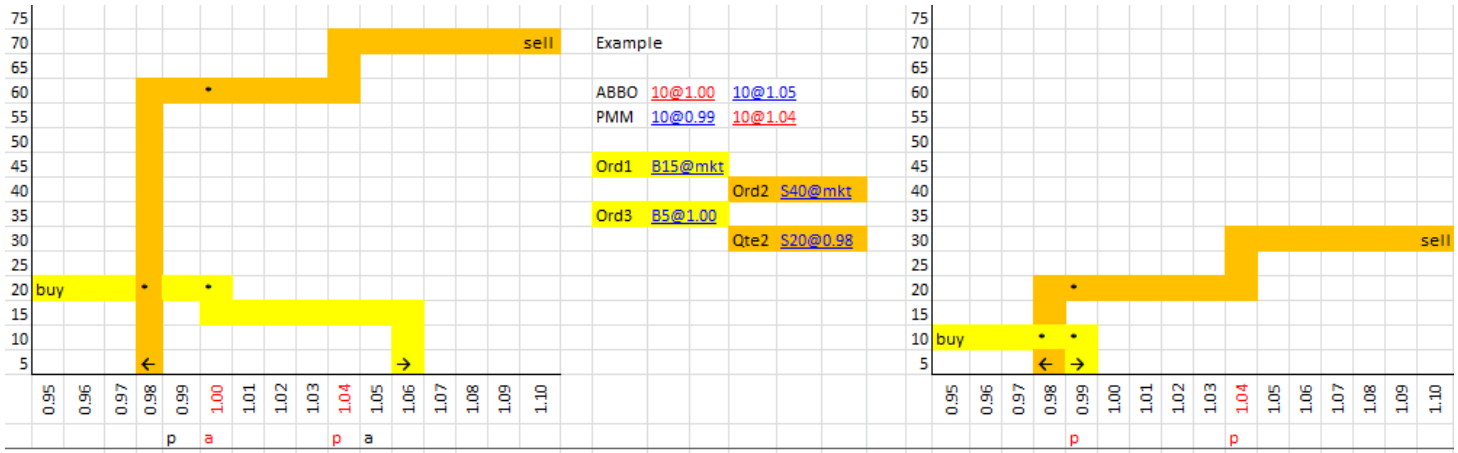
Iteration 1					Iteration 2					Iteration 3				
B	PMM	B10@1.01			**B**	3-tick	0.99	rmv pmm b10@1.01		**B**	no boundary		rmv 3-tick @0.99	
	PMM	S10@1.06				PMM	S10@1.06	sell side hasn't been used so don't remove			PMM	S10@1.06	sell side hasn't been used so don't remove	
POP		25@0.96	AQF w/ valid interest		**POP**		10@0.95	AQF w/ valid interest		**POP**	0.95		AQF w/ valid interest	
FOP	adj	25@1.01	pmm boundary		**FOP**	adj	5@0.99	3-tick boundary		**FOP**	no adj	5@0.95	no boundary; then final = prelim	
			note POP adj price					note POP adj price & size						
T&A	PMM	B10@1.01			**T&A**	Ord3	B5@0.99			**T&A**	Ord4	B5@0.95		
	Ord1	B15@1.01				Ord2	S5@0.99	lvs	S10@0.96		Qte2	S5@0.95	lvs	S15@0.95
	Ord2	S25@1.01	lvs	S15@0.96		Ord4		lvs	B5@0.95		PMM		lvs	S10@1.06
	Ord3		lvs	B5@1.00		Qte2		lvs	S20@0.95					
	Ord4		lvs	B5@0.95		PMM		lvs	S10@1.06	**OP**	n/a			
	Qte2		lvs	S20@0.95										
	PMM		lvs	S10@1.06	**OP**	Ord2	S10@0.96	3-tick lock			orderbook is no longer crossed			
											post best bid/ask			
OP	no orders lock/cross ABBO					orderbook is crossed start iteration 3					Qte2	S15@0.95		
	orderbook crossed start iteration 2													

B.3. Examples 3. PMM Boundary Considered First



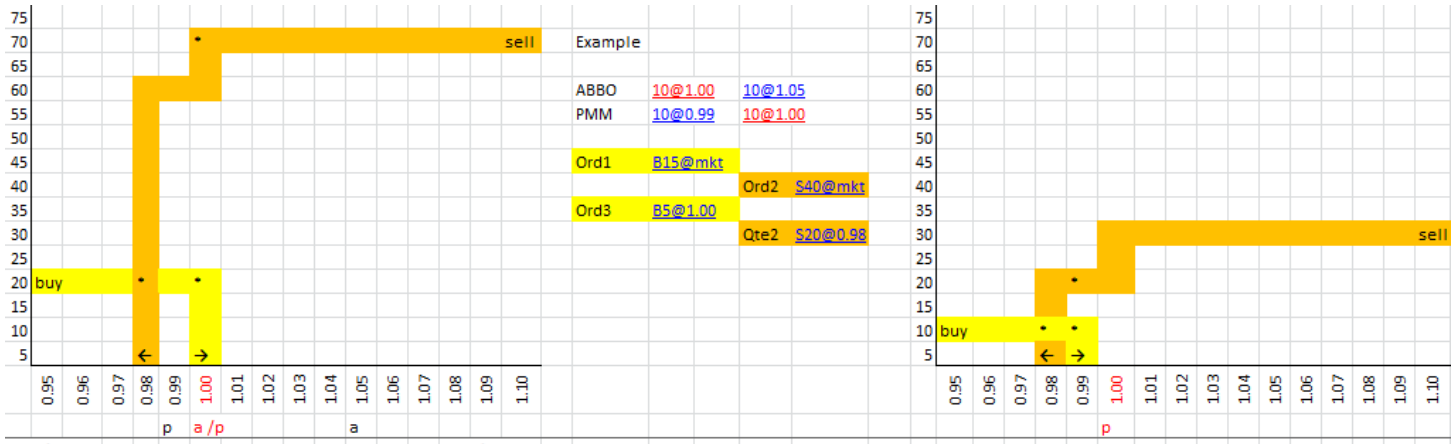
Iteration 1					**Iteration 2**			
B	PMM	B10@1.01			**B**	ABBO	B10@1.00	rmv pmm b10@1.01
	ABBO	S10@1.05				ABBO	S10@1.05	sell side hasn't been used so don't remove
POP		25@0.98	AQF w/ valid interest		**POP**		5@0.98	AQF w/ valid interest
FOP	adj	25@1.01	pmm boundary		**FOP**	adj	5@1.00	abbo boundary
			note POP adj price					note POP adj price
T&A	PMM	B10@1.01			**T&A**	Ord3	B5@1.00	
	Ord1	B15@1.01				Ord2	S5@1.00	lvs S10@mkt
	Ord2	S25@1.01	lvs	S15@mkt		Qte2		lvs S20@0.98
	Ord3		lvs	B5@1.00		PMM		lvs S10@1.06
	Qte2		lvs	S20@0.98				
	PMM		lvs	S10@1.06	**OP**	Ord2	S10@mkt	flash/amb
								locks/crosses ABBO bid
OP	no orders lock/cross ABBO yet					orderbook is no longer crossed		
						post best bid/ask		
	orderbook crossed start iteration 2					Qte2	S20@0.98	

B.4. Example 4. ABBO Boundary Considered First



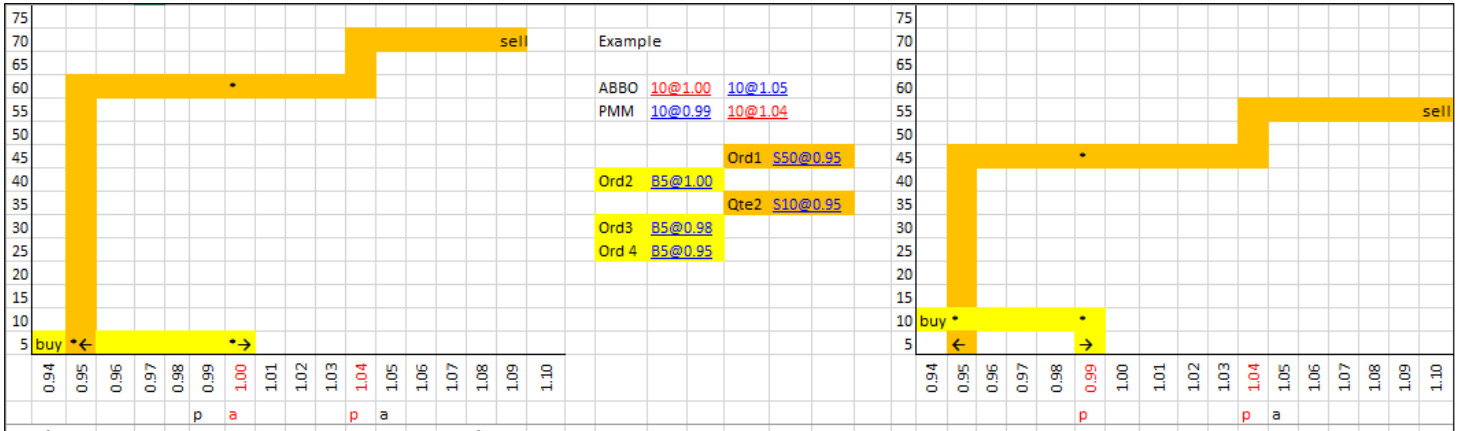
Iteration 1				**Iteration 2**			
B	ABBO	B10@1.00		**B**	PMM	B10@0.99	rmv abbo10@1.00
	PMM	S10@1.04			PMM	S10@1.04	sell side hasn't been used so don't remove
POP	0.98	20@0.98	AQF w/ valid interest	**POP**		10@0.98	AQF w/ valid interest
FOP	adj	20@1.00	abbo boundary	**FOP**	adj	10@0.99	PMM boundary
			note POP adj price				note POP adj price
T&A	Ord1	B15@1.00		**T&A**	PMM	B10@0.99	
	Ord3	B5@1.00			Qte2	S10@0.99	lvs S10@0.98
	Ord2	S20@1.00	lvs S20@mkt		PMM		lvs S10@1.04
	PMM		lvs B10@0.99				
	Qte2		lvs S20@0.98				
	PMM		lvs S10@1.04	**OP**	orders protected in iteration 1		
OP	Ord2	s20@mkt	flash/amb		orderbook is no longer crossed		
			locks/crosses ABBO bid		post best bid/ask		
					Qte2	s10@0.98	
	orderbook crossed start iteration 2						

B.5. Example 5. PMM and ABBO Locked Boundary Price



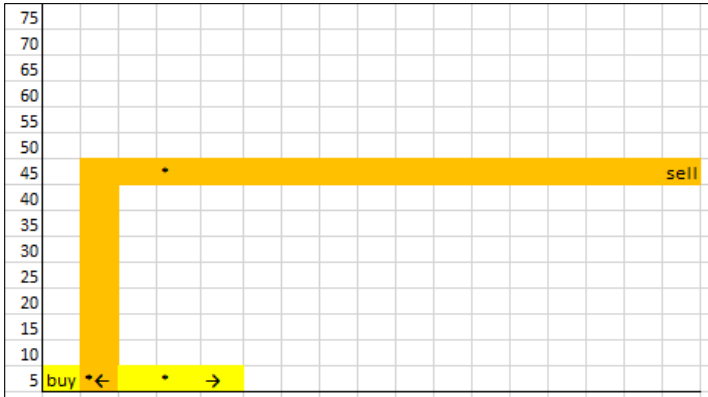
Iteration 1				**Iteration 2**			
B	ABBO	B10@1.00		**B**	PMM	B10@0.99	rmv abbo10@1.00
	PMM	S10@1.00			PMM	S10@1.00	sell side hasn't been used so don't remove
POP		20@0.98	AQF w/ valid interest	**POP**		10@0.98	AQF w/ valid interest
FOP	adj	20@1.00	abbo boundary	**FOP**	adj	10@0.99	PMM boundary
			note POP adj price				note POP adj price
T&A	Ord1	B15@1.00		**T&A**	PMM	B10@0.99	
	Ord3	B5@1.00			Qte2	S10@0.99	lvs S10@0.98
	Ord2	S20@1.00	lvs S20@mkt				
	PMM		lvs B10@0.99				
	Qte2		lvs S20@0.98				
	PMM		lvs S10@1.00				
				OP	orders protected in iteration 1		
OP	Ord2	s20@mkt	flash/amb				
			locks/crosses ABBO bid		orderbook is no longer crossed		
					post best bid/ask		
	orderbook crossed start iteration 2				Qte2	S10@0.98	

B.6. Example 6. PMM and ABBO Boundary, 3-Tick Lock Non-Cust, 4th Iteration

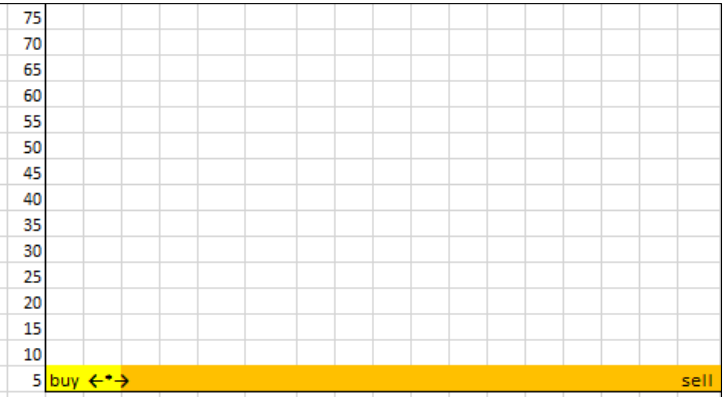


Iteration 1				**Iteration 2**			
B	ABBO	B10@1.00		**B**	PMM	B10@0.99	rmv abbo10@1.00
	PMM	S10@1.04			PMM	S10@1.04	sell side hasn't been used so don't remove
POP		5@0.95	AQF w/ valid interest	**POP**		10@0.95	AQF w/ valid interest
FOP	adj	5@1.00	abbo boundary	**FOP**	adj	10@0.99	pmm boundary
			note POP adj price				note POP adj price
T&A	Ord2	B5@1.00		**T&A**	PMM	B10@0.99	
	Ord1	S4@1.00	lvs S46@0.95		Ord1	S8@0.99	lvs S38@0.95
	Qte2	S1@1.00	lvs S4@0.95		Qte2	S2@0.99	lvs S7@0.95
	PMM		lvs B10@0.99		Ord3		lvs B5@0.98
	Ord3		lvs B5@0.98		Ord4		lvs B5@0.95
	Ord4		lvs B5@0.95				
	PMM		lvs S10@1.04	**OP**	n/a Ord1 is non-cust can trade through abbo		
OP	n/a Ord1 is non-cust can trade through abbo				orderbook crossed start iteration 3		
	orderbook crossed start iteration 2						

Example 6, continued:

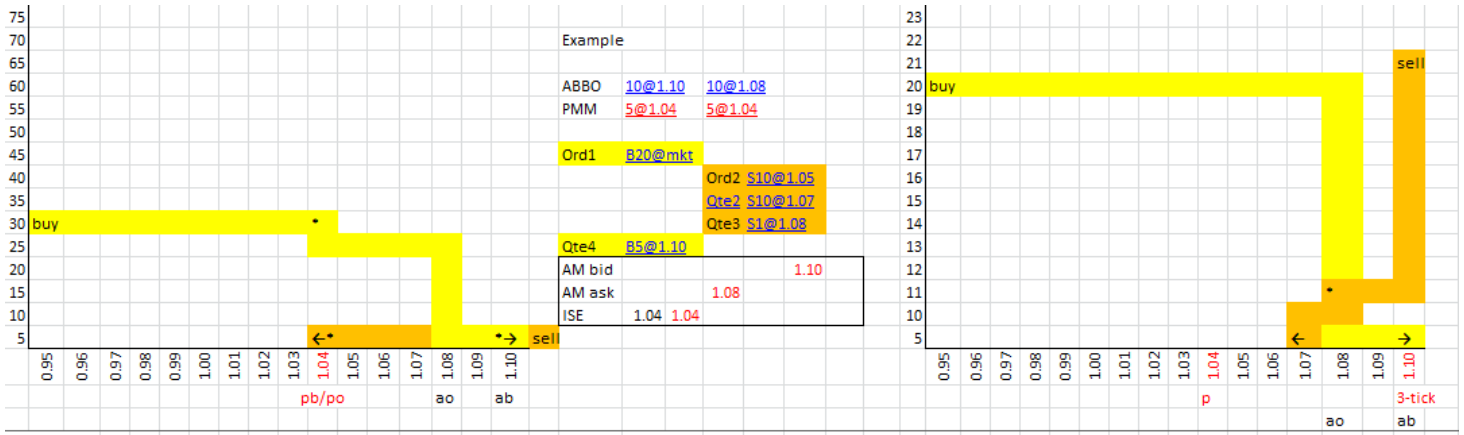


Iteration 3				
B	3-tick	0@0.97	rmv PMM 10@0.99	
	PMM	S10@1.04	sell side hasn't been used so don't remove	
POP		5@0.95	AQF w/ valid interest	
FOP	adj	5@0.97	3-tick boundary	
			note POP adj price	
T&A	Ord3	B5@0.97		
	Ord1	S4@0.97	lvs	S34@0.95
	Qte2	S1@0.97	lvs	S6@0.95
	Ord4		lvs	B5@0.95
OP	Ord1	S34@0.95	3-tick lock	
			cancel any balance	



Iteration 4				
B	no boundary		rmv 3-tick 0@0.97	
	PMM	S10@1.04	sell side hasn't been used so don't remove	
POP		5@0.95		
FOP		5@0.95	no boundary; then final = prelim	
T&A	Qte2	S5@0.95	lvs	1@0.95
	Ord4	B5@0.95		
OP	orders protected in iteration 3			
	orderbook is no longer crossed			
	post best bid/ask			
	Qte2	s1@0.95		

B.7. Example 7. Away Bid Inverted with ISE Offer and Away Bid and Offer Inverted



Iteration 0

B	Inverted Market detected ABBO excluded from consideration			
EF	Ord1	B20@mkt	[1.08]	effective price = to away offer
	Ord2	S10@1.05	[1.10]	effective price = to away bid
	orderbook is crossed			
	ABBO excluded, effective price established for customer orders			
	Start normal iterative opening			

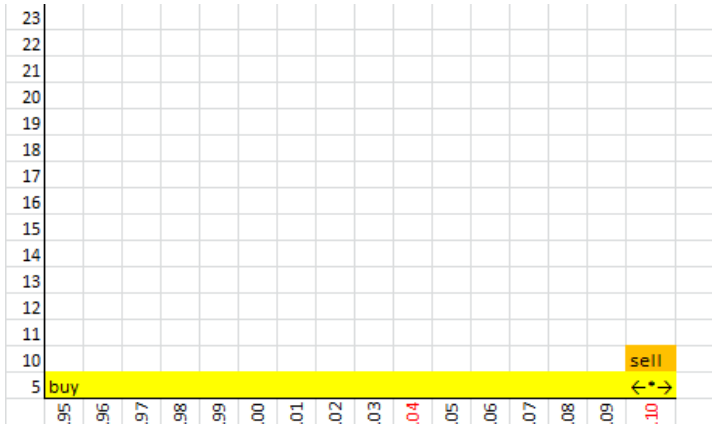
Iteration 1

B	PMM	B5@1.04		
	PMM	S5@1.04		
POP		5@1.09	AQF w/ valid interest & effective price	
FOP	adj	5@1.04	pmm boundary	
			note POP adjusted price	
T&A	Ord1	B5@1.0	lvs	B15@mkt [1.08]
	PMM	S5@1.04		
	Ord2		lvs	S10@1.05 [1.10]
	Qte2		lvs	S10@1.07
	Qte3		lvs	S1@1.08
	PMM		lvs	B5@1.04
OP	n/a order protection is not done yet			

Iteration 2

B	PMM	B5@1.04	buy side hasn't been used so don't remove	
	3-tick	0@1.10	ABBO + 3-tick	
POP		11@1.08	AQF w/ valid interest & effective price	
FOP	no adj	11@1.08	POP is w/in boundary	
T&A	Ord1	B11@1.08	lvs	B4@mkt [1.08]
	Qte2	S10@1.08		
	Qte3	S1@1.08		
	Ord2		lvs	S10@1.05 [1.10]
	Qte4		lvs	B5@1.10
OP	n/a order protection is not done yet			

B.7.1 Example 7 Continued:



Iteration 3			
B	PMM	B5@1.04	buy side hasn't been used so don't remove
	3-tick	0@1.10	sell side hasn't been used so don't remove
POP		5@1.10	AQF w/ valid interest & effective price
FOP	no adj	5@1.10	POP is @ boundary
T&A	Ord2	S5@1.10	lvs 5@1.05 [1.10]
	Qte4	B5@1.10	
OP	Ord1	B4@mkt [1.08]	flash/amb
			effective price 1.08 locks/crosses ABBO
	Ord2	S5@1.05 [1.10]	flash/amb
			effective price 1.10 locks crosses ABBO
	orderbook is no longer crossed		
	post best bid/ask		