NASDAQ OMX | NFX

Rule Self-Certification

February 24, 2015

VIA ELECTRONIC PORTAL

Christopher J. Kirkpatrick
Office of the Secretariat
Commodity Futures Trading Commission
Three Lafayette Center
1155 21st Street, N.W.
Washington, DC 20581

Re: **Regulation §40.6 Submission Certification**
Technical Reference
Reference File: SR-NFX-2015-07

Dear Mr. Kirkpatrick:

Pursuant to Section 5c(c)(1) of the Commodity Exchange Act, as amended ("Act"), and Section 40.6(a) of the regulations promulgated by the Commodity Futures Trading Commission under the Act, NASDAQ Futures, Inc. ("NFX" or "Exchange") adopts a new Technical Reference Guide entitled "Combination and Implied Orders." The new Technical Reference Guide will be implemented on May 1, 2015. The text of this Technical Reference Guide is set forth in Exhibit A.[1] In addition, the Exchange is proposing to correct certain rule text that was previously filed in SR-NFX-2014-02 in Chapter IV, Section 4, entitled "Acceptable Orders" related to two types of Combination Orders, conversions and reversals. The rule text references to buying and selling were inverted in that filing. This rule change corrects that error. The amendments are attached in Exhibit B and will be implemented on April 1, 2015. Finally, the Exchange is proposing to amend the text of a Reference Guide that was previously filed in SR-NFX-2015-01 to similarly amend references related to two types of Combination Orders, conversions and reversals. The amendments are attached in Exhibit C and will be implemented on May 1, 2015.

The Exchange recently filed amendments to its Trading Rules which will be implemented on April 1, 2015.[2] Among other things, the rule change adopted revised and new trading rules in Chapter IV entitled "Trading System." The Exchange is adopting this Technical Reference Guide to provide further guidance to market participants with respect to entering Combination and Implied Orders

[1] Exhibit A reflects amendments to the Exchange's Rulebook as filed in SR-NFX-2014-02, SR-NFX-2014-05 and SR-NFX-2015-01.

[2] See SR-NFX-2014-02, SR-NFX-2014-05 and SR-NFX-2015-01.

into the Trading System. This Technical Reference Guide will be posted on the Exchange's website to provide market participants additional information with respect to entering Combination and Implied Orders on the Exchange.

With respect to the designated contract market core principles ("Core Principles") as set forth in the Act:

• *Compliance with Rules*: Today the Exchange has in place Rules which describe the manner in which Futures Participants may access and trade on NFX. Chapter II, Section I provides for the qualifications and rules of participation applicable to Futures Participants as well as Authorized Traders. This Rule states that Futures Participants must utilize the Exchange's services in a responsible manner, comply with Rules, cooperate with Exchange investigations and inquiries and observe high standards of integrity. In addition the Rule provides clear and transparent access criteria and requirements for Futures Participants and Authorized Traders. Chapter V, Section 18 describes prohibited activities with respect to the Trading System.

Trading will be subject to the Rules at Chapter III of the Exchange's Rulebook, which include prohibitions against fraudulent, noncompetitive, unfair and abusive practices. Additionally, trading is subject to the trading procedures and standards in Chapter V of the Rulebook. Trading activity is subject to extensive monitoring and surveillance by NFX's regulatory group in conjunction with the National Futures Association pursuant to the provisions of a Regulatory Services Agreement. Additionally, the Exchange has the authority to exercise its investigatory and enforcement power where potential rule violations are identified. The Exchange's disciplinary Rules are contained in Chapter VI of the Rulebook, which permit the Exchange to discipline, suspend or expel Futures Participants or market participants that violate the Rules. Pursuant to Chapter V, Section 5, the Exchange may cancel or adjust trades when necessary to mitigate market disrupting events caused by the improper or erroneous use of the Trading System or system defects or malfunctions. The Exchange may review a trade based on its independent analysis of market conditions or upon request from a Futures Participant.

• *Prevention of Market Disruption*: The Exchange's Regulatory Department, which handles real-time surveillance, monitors trading activity on the Exchange with a SMARTS Surveillance Application through which the Exchange can track activity of specific Authorized Traders, monitor price and volume information and receive alerts regarding market messages. The

Exchange's Regulatory Department, which handles real-time surveillance in conjunction with staff that handles T+1 surveillance, utilizes data collected by the SMARTS Surveillance Application to monitor price movements, as well as market conditions and volumes to detect suspicious activity such as manipulation, disruptive trading and other abnormal market activity. The Exchange has established comprehensive audit trail processes that capture trading information to facilitate the surveillance activities described herein. Futures Participants that access the Exchange electronically are responsible for maintaining audit trail information for all electronic orders pursuant to Chapter V, Section 1. The Exchange has in place risk controls, including the imposition of trading pauses or halts, to address risks posed by potential market disruptions pursuant to Chapter V, Section 16. The Exchange has the ability to reconstruct all Orders transacted on the Trading System.

• *Availability of Contract Information.* The Exchange has indicated within its trading Rules where specific information relates to a particular Contract. The Exchange will provide detailed information within the contract specifications for that particular Contract. The Exchange will post the terms and conditions of Exchange Contracts in its Rulebook along with trading Rules. The specifications for its Trading System will appear on the Exchange's website.

• *Publication of Information.* The Exchange will publish daily information on settlement prices, volume, open interest and opening and closing ranges for actively traded Contracts on its website. The Exchange's volume information will include information on the volume of Block Trades.

• *Execution of Transactions.* The Exchange operates an electronic trading facility that provides Futures Participants with the ability to execute Orders within the Exchange's Order Book and offers within a predetermined automated trade matching and execution algorithm. Orders submitted into the Trading System will continue to be matched in either Price-Time priority or Size Pro-Rata priority order, as specified by the Exchange. The Exchange specifies the types of Orders that will be accepted by the Trading System in recently filed Chapter IV, Section 4. Finally, the Exchange separately describes its Rules for executing transactions outside of the Order Book, such as Block Trades and exchange for related positions (EFRPs), in recently filed Chapter IV, Sections 10 and 11 respectively. The Exchange recently added new Options Rules at Chapter VIII in order that both futures and options on futures may be traded on NFX.

• *Trade Information.* As previously described, the Exchange has established audit trail processes that capture trading information to facilitate the Exchange's trade practice and market surveillance activities. The audit trail program is based on original source documents that are unalterable, sequentially identified records. The audit trail contains a history of all Orders as well as other identifying information. All data gathered as part of the audit trail is maintained in accordance with the Commission's recordkeeping requirements and in a manner that does not allow for unauthorized alteration, erasure or other potential loss.

• *Financial Integrity of Transactions.* The Exchange's Rules provide that all matched trades generated by the Trading System, after the application of pre-trade risk parameters, will be automatically submitted to the Clearing Corporation as described in Chapter V, Section 2. Chapter II, Section 1 of the Exchange's Rules requires that all Futures Participants must be members of the Clearing Corporation either directly or indirectly. Futures commission merchants (FCMs) must maintain an account directly with the Clearing Corporation. Clearing Futures Participants are required to guarantee all trades transacted on NFX on behalf of itself, its Customers and Non-Clearing Futures Participants. Clearing Futures Participants must guarantee and assume financial responsibility for all Exchange Contracts of each Futures Participant guaranteed by it, and will be liable for all trades made by that Futures Participant. The Exchange requires a similar guarantee for Authorized Customers submitting trades into the Trading System via Direct Access pursuant to Chapter V, Section 4. The Exchange's Rules governing minimum financial requirements and protection of Customer funds are set forth in Chapter III.

• *Protection of market participants.* Chapter III of the Exchange's Rulebook contains prohibitions precluding intermediaries from disadvantaging their customers. These rules apply to trading in all Contracts.

There were no opposing views among the Exchange's Board of Directors, members or market participants. The Exchange hereby certifies that this Technical Reference Guide complies with the Commodity Exchange Act and regulations thereunder. The Exchange also certifies that a notice of pending certification with the Commission and a copy of this submission have been concurrently posted on the Exchange's website.

If you require any additional information regarding the submission, please contact Angela S. Dunn at +1 215 496 5692 or via e-mail at angela.dunn@nasdaq.com. Please reference SR-NFX-2015-07 in any related correspondence.

Regards,

Daniel R Carrigan

Daniel R. Carrigan
President

cc: National Futures Association

Exhibit A

[Technical Reference Guide - Combination and Implied Orders]

Nasdaq Futures, Inc. (NFX) Combination & Implied Orders

Technical Reference Document

Version 1.00 | 2015-5-01

CONFIDENTIALITY/DISCLAIMER

This Combination and Implied Orders Techinical Reference Guide is being forwarded to you strictly for informational purposes and solely for the purpose of developing or operating Trading Systems for your use that interact with Trading Systems of NASDAQ Futures, Inc. (NFX^{SM}) and its affiliates (collectively, NFX). This specification is proprietary to NFX.

NFX reserves the right to withdraw, modify, or replace this reference guide at any time, without prior notice. No obligation is made by NFX regarding the level, scope or timing of NFX's implementation of the functions or features discussed in this specification. The reference guide is provided "AS IS," "WITH ALL FAULTS". NFX makes no warranties to this reference guide or its accuracy, and disclaims all warranties, whether express, implied, or statutory related to the reference guide or its accuracy. This document is not intended to represent an offer of any terms by NFX. While reasonable care has been taken to ensure that the details contained herein are true and not misleading at the time of publication, no liability whatsoever is assumed by NFX for any incompleteness or inaccuracies. By using this reference guide you agree that you will not, without prior written permission from NFX, copy or reproduce the information in this reference guide except for the purposes noted above. You further agree that you will not, without prior written permission from NFX, store the information contained in this reference guide in a retrieval Trading System, or transmit it in any form or by any means, whether electronic, mechanical, or otherwise except for the purposes noted above. In addition you agree that you will not, without prior written permission from NFX, permit access to the information contained herein except to those with a need-to-know for the purposes noted above.

Table of Contents

1. Combination Strategies

The Trading System supports the trading of Strategies also referred to as Combination Orders, which will trade in a separate Combination Order Book. The Exchange may list Futures and/or Options Combination Orders for trading, and Participants and Users may create their own custom or tailor made Combination (TMC) Orders for Futures and/or Options not already defined in the Trading System. A Participant is defined as a Clearing Futures Participant, Futures Participant, or Authorized Customer. A User is defined as an Authorized Trader. (See NFX Reference Guide, Section 2.3, Relational Model) Participants and Users may submit Day Combination Orders that, if matched, will simultaneously trade the referenced single leg Instruments according to the specified strategy without execution risk. Once created intraday, TMC Orders will be visible in the Combination Order Book to the entire market and will remain in force until the end of Trading Hours for the Contract.

Instruments	A TMC Order may be comprised of a minimum of two, but not exceed four Instruments within the same or from different underlying Instruments. It is possible to have a relative ratio of up to 4:1 between the included Instruments. Inter-Commodity Spreads may be formed with a minimum of two Instruments but may not exceed four Instruments.
No Execution Risk	Strategies that are TMC or pre-defined Combination Orders all Instruments will be simultaneously executed at a net price without execution risk, for each Instrument respectively including underlying legs.
Price	The price for an Order shall be stated as a common net price, i.e. the premium times the ratio for the Instrument to be bought minus the premium times the ratio for the Instrument to be sold.
Combination Order Book	When the TMC Order is created, it will appear in a Combination Order Book which is visible to the entire market.
Easy to Use	Users create the TMC Order by defining the Instruments, Expiry and Contract. A User would then identify the ratio between the Instruments as well as the number of contracts and the net price.
Implied-In Orders	Implied-in Order prices are automatically calculated by the Trading System but are not published. When a TMC Order is entered, the Order will be matched in the Order Book utilizing Implied-In Order prices from the respective leg Order Book.
Implied-Out Orders	Implied-out Orders are automatically generated by the Trading System are are published. When a TMC Order is entered into the Trading System, it will match against existing Orders for that combination as well as against the respective leg Order Book. For each respective leg Order Book, where possible, the Trading System utilized the market prices of all other included instruments to calculate the TMC Order with a theoretical price needed to trade at in order to execute the entire Combination Order at the net price. This TMC Order will be placed into the Order Book as an Implied-Out Order. If the Implied-Out Order is traded, the Trading System will simultaneously trade against Orders in all other instruments., Implied-out Orders are calculated by the Trading System, but will only be published for Instruments where the ratio is 1 (excluding Inter-Commodity Spreads).

1.1 Introduction to Combination Strategies

When trading financial Instruments, there are numerous strategies where a Combination Order comprised of different Options or Futures Contracts, gives the buyer or seller a certain position. Examples of these include:

- **Buy and Write (a.k.a. Covered Call)** – Buy a Futures Contract, and write call Options.
- **Call (Put) Spreads** – Buy and sell two call (put) Options of the same underlying and expiration but with different strikes.
- **Calendar (Horizontal) Spreads, Time Spreads** - Buy and sell two call (put) Options of the same underlying and strike, but with different expirations.
- **Straddles** – Buy a call Option and a put Option of the same underlying, expiration and strike.
- **Strangles** – Buy a call Option and a put Option of the same underlying and expiration, but with different strikes.
- **Conversion** – Sell a call Option and Buy a put Option of the same underlying, expiration and strike at the same time as buying the underlying, or an underlying Future.
- **Reversal** - Buy a call Option and sell a put Option of the same underlying, expiration and strike at the same time as selling the underlying short, or selling an underlying Future.
- **Butterfly Spread** – A Contract strategy consisting of three legs either for Futures or Options. Butterfly Option Spreads consist of three put and/or call Contracts. Butterfly Futures Spreads consist of three Contracts.
- **Condor and Iron Condor Spreads** – A Contract strategy consisting of four legs. Condor Options Spreads consist of four Options Contracts (all put or all call Contracts). Condor Futures Spreads consist of four Futures Contracts. Iron Condor Options Spreads consist of four Options Contracts (two put and two call Contracts).
- **Intra-Commodity (Time) Spread** – Combination Orders may be formed by buying and selling two Futures of the same underlying, but with different expirations. Combination Orders may be formed by two different Future Expiries (NFX WTI Crude Oil Financial Futures, March versus June contract).
  - The price ratio for the underlying legs will be configured to an integer of one. There will be no change to the trading tick size.
- **Inter-Commodity Spread** – Combinations may be formed of two or three different underlying Futures Contracts (NFX WTI Crude Oil Financial Futures versus NFX RBOB Gasoline Financial Futures versus NFX Heating Oil Financial Futures "Crack Spread").
  - The price ratio for the underlying legs will be configured to an integer of less than one, but rounded to four decimal places to the right from an initial calculation of fourteen places. Accordingly, the minimum price interval for a respective leg price is one hundredth of a cent ($0.0001) versus its outright leg trading tick which may be 0.01.

An example of a Time Spread NFX WTI Crude Oil Financial Future:

- Buy 1 NFX WTI Crude Oil Financial Future April 2015 contract
- Sell 1 NFX WTI Crude Oil Financial Future March 2015contract

Combination Orders are traded in a Combination Order Book. It is possible that the Combination Order can execute against another Combination Order, or (if configured) can execute against Orders in the single Order Book legs.

If not executable on entry, Combination Orders are stored in the Combination Order Book until such time as they are executable.

In addition, the Trading System is configured to generate automatic "Implied" Orders in the Order Books specified within the Combination Order (i.e. the legs) that are automatically re-calculated when prices change. Such Combination Order Books are generated by the Trading System, or, alternatively, may be defined by Futures Participants' Authorized Traders (User) pursuant to the rules of the Exchange.

1.2 Combination Orders

Combination Orders require that a Combination Order Book be pre-defined in the Trading System by the Exchange. An example of a Combination Order within the Combination Order Book could be:

Combination Order Book Time Spread NFX WTI Crude Oil Financial Future:

- Buy 1 NFX WTI Crude Oil Financial Future April 2015 contract
- Sell 1 NFX WTI Crude Oil Financial Future March 2015 contract

Combination Orders are stored in the Combination Order Book until they are executed, either in the respective Order Book legs or directly in the Combination Order Book itself (i.e. a Combination to Combination match). It is configurable if integration with single Order Books (legs) by Contract should occur.

Combination Orders specify a quantity and whether they are buying or selling the Combination. Combination Order Books are priced using a net price method described below..

If integration with single Order Books should occur, Implied Orders are available for trading. Implied Orders (also known herein as Derived Orders) are Orders automatically generated by the Trading System for the purpose of trading Combinations. Orders, which are Implied, are calculated and posted in single respective leg Order Books. Implied Orders display the liquidity available in the marketplace derived from available Combination Orders. Implied Orders are generated only during the continuous matching in the Open Session.

1.2.1 Defining Combination Order Books

Combination Order Books can be either Exchange-defined ("Standard") or User-defined ("Tailor-Made") Combination Order Books. The Exchange-defined Combination Order Books, described herein, may be created by NFX Market Operations, or otherwise automatically generated by the Trading System for the more popular Combination Orders (based on underlying prices and time). Futures Participants' Authorized Traders may create their own Combination Order Books for Combination Orders they want to trade subject to the rules of the Exchange. Once a User-defined Combination Order Book has been defined, trading will be subject the same rules as trading any other Combination Order. A Combination Order Book is made up of multiple respective single Order Book leg(s). For each leg, a side (whether to buy or sell) and ratio must be specified (how much to buy or sell of the leg per unit of the Combination) when entering the Order into the Trading System.

A Combination Order Book may specify both buys and sells of its single Order Book legs (e.g. buying the Combination Order equals buy leg A and sell leg B). For each leg, selling the Combination Order will always mean the opposite to buying the Combination Order. The convention of "buying and selling" the Combination Order as such makes trading in Combination Orders more comparable to trading in single Order Books.

For example:

<u>Buying Combination Order Book Time Spread NFX WTI Crude Oil Financial Future (Order Book C):</u>

- Buy 1 NFX WTI Crude Oil Financial Future April 2015 contract
- Sell 1 NFX WTI Crude Oil Financial Future March 2015 contract

A buyer of Order Book C would be buying NFX WTI Crude Oil Financial Future April 2015 Future and selling the March Future.

A seller of Order Book C would be selling NFX WTI Crude Oil Financial Future April 2015 Future and buying the March Future

1.2.1.1 Ratios

A ratio is defined for each leg of the Combination Order. Ratios define the quantity of the leg relative to the quantity of the Combination Order and are reflected in a given net price of the Combination Order (see also Pricing Combinations).

For example:

<u>Buy Combination Order Book C:</u>

Buy 1 unit of Order Book leg A (current BBO is 14-15)

Sell 2 units of Order Book leg B (current BBO is 5-6) where 1 and 2 are the ratios for the legs

A buyer of Order Book C would pay a net price of 5 per unit ((1 * 15) - (2 * 5)).

A seller of Order Book C (i.e. Sell 1 unit leg A and Buy 2 units of leg B) would receive a net price of 2 per unit (-(1 * 14) + (2 * 6)).

The ratio for the legs should always be given with the smallest common denominator. A Combination Order to buy 10 contracts of Order Book leg A, and sell 20 contracts of Order Book leg B, is instead configured to buy 1 of A, sell 2 of B, and the resulting lot size for the Combination Book is set to 10 contracts.

1.2.1.2 Order Book Handling

1.2.1.2.1 Combination to Single Leg

When Combination Orders are traded against single Orders, the execution algorithm designated by the Exchange for the single Order Book is followed.

The calculated quantity of each leg (e.g. Combination Order Quantity * Leg Ratio) must be valid in regards to the lot type of the single Order Book leg.

1.2.2 Pricing Combinations

The Trading System utilizies the net price "Net Price" method for pricing Combination Orders:

Net Price is the sum of the Price * Ratio for all legs.

If buying the Combination Order, the price of a bought leg is added and the price of a sold leg is subtracted:

$$\text{Buy Net Price} = \text{Buy} - \text{Sell}$$

For example:

A Combination Order Book, C is defined as

- Buy 2 units of Order Book leg A (current BBO is 7-8)

- Sell 1 unit of Order Book leg B (current BBO is 11-12)

for each bought contract of the Combination Order:

where 1 and 2 are the ratios for the legs

A buyer of Order Book C would pay a net price of 5 per unit , ((2*8) - (1*11))

If selling the Combination Order, the reverse is true:

$$\text{Sell Net Price} = \text{Sell} - \text{Buy}$$

A seller of Order Book C (i.e. Sell 2 unit leg A and Buy 1 units of leg B) would *receive* a net price of 2 per unit ((2*7) - (1 * 12)).

If buying the Combination Order, the price of a bought leg (which is a buy-leg in the Combination Order definition) is added, and the price of a sold leg is subtracted. The result of this is that theprice for a Combination Order is:

- a positive value, when
  - the Authorized Trader is buying the Combination Order and is willing to pay, or
  - the Authorized Trader is selling the Combination Order and wants to be paid; and is
- a negative value, when
  - the Authorized Trader is buying the Combination Order and wants to be paid, or
  - the Authorized Trader is selling the Combination Order and is willing to pay.

When using Net Price, Contract legs could have a pricing unit ("Pricing Unit") of Price or Percent of nominal, but all legs should have the same Pricing Unit, to get a relevant result. All Contract legs, as well as the Combination Orders must have ascending price ranking. Note that the positive and negative value behavior described above do not always hold true when a Combination Order is made up of legs with different contract sizes.

1.2.3 Matching - Combination-to-Combination

If Combination Orders are matched against other Combination Orders, the matching follows the defined ranking and matching rules (see Ranking & Matching) for the Combination Order Book itself.

Note that trades sent to the clearinghouse (The Options Clearing Corporation or OCC) are reported in the single Order Books. For Combination-to-Combination matches, the Trading System calculates the prices and quantities in the legs needed for the downstream Trading Systems and processes.

The split of Combination to Combination Order strategies is made by a downstream process. One effect of that, is that such a trade will never update the last match price in the single Order Books, and can therefore not cause triggering of Orders dependent of that price.

Another effect of that, is that such a trade will never update the last match price in the single Order Books, and cannot update the price limits for last price.

Following is an example of a Combination-to-Combination Order match.

Given the following Combination Order traded in net price:

Buy Instrument A ratio = 1, Sell Instrument B ratio = 1

Combination Order Book			
100	$8.50	$9.10	110
50	$8.45	$9.20	100

A Combination Order comes in to sell 120 @ 8.40

Order matches both buy Orders.

1.2.3.1.1 Try to find two-way leg prices

If any of the legs do not have two-way prices, the Trading System will utilize a reference price as described below and apply a theoretical spread.

1.2.3.1.1.1 Reference Price Definition

One of the following priceswill be the reference price ("Reference Price"):

- current best bid/best offer ("BBO");
- historic BBO;
- last paid price;
- closing price;
- Reference Price received from external source via the FIX API;
- manually entered by NFX Market Operations; or
- last auction price.

If several Reference Prices are available, then the last updated Reference Price will be selected by the Trading System. For example, if an auction has been completed, this Reference Price will be used instead of the Closing Price. A subsequent manual update by NFX Market Operations will supersede the last auction price, and so on.

1.2.3.1.1.2 Calculate a theoretical spread

Find bid and ask prices for all legs, to use in coming price validations

Theoretical Spread in Number of Ticks = ThSpTicks. This will be set equal to the largest existing spread for any of the legs + 1 tick, always rounded to an even number of ticks, or if none of the legs has a current BBO, to 20 ticks.

For each leg:

- if Bid exists, but not Ask, set
  - o Ask = Bid increased with ThSpTicks number of ticks
- if Ask exists, but not Bid, set
  - o Bid = Ask decreased with ThSpTicks number of ticks
- if neither Bid nor Ask exist set, but Bid did exist as last previous Order, set
  - o Ask = Last previous Bid increased with ThSpTicks number of ticks
- if neither Bid nor Ask exist set, but Ask did exist as last previous Order, set
  - o Bid = Last previous Ask decreased with ThSpTicks number of ticks
- if neither Bid nor Ask exist, and no previous Bid or Ask did exist, set
  - o Bid = Reference decreased with (ThSpTicks/2) number of ticks
  - o Ask = Reference increased with (ThSpTicks/2) number of ticks
  - o If no reference price exists and the configuration parameter Leg Prices Outside BBO allowed is set to YES, Bid = Lowest Tick and Ask = $100.00

Break Combination Trade Matches into Single Legs

When Combination-to-Combination Orders should be split into in single legs, an algorithm for finding prices and quantities for the single legs is applied. The algorithm chooses prices for the legs, so that they are within the current bid/ask spread to the largest possible point. The algorithm allows for multiple matches in one single Order Book, if this is necessary to find appropriate prices which are at the minimum trading tick.

1.2.3.1.2 Leg-Price Algorithm

1.2.3.1.2.1 General assumptions

The algorithm for calculating leg prices for Combination-Combination Order matches is based on a few preconditions and assumptions on acceptable leg prices. The algorithm will provide a solution in a fixed number of steps given that the preconditions are fulfilled.

- Prices are available for all legs in all cases. This means that if current bid/ ask figures are missing, a Reference Price will be used to calculate a spread. If no Reference Price exists and the configuration parameter leg prices outside BBO Allowed is set to YES, the spread of Lowest Tick - $100.00 is used.
- If net price is within the derived Combination Order spread, the algorithm strives to find single prices that are within single spread, and on tick sizes. To help achieve this, multiple trades can be written for one leg, and/or prices on single legs can be off tick size.
- The Order in which prices are decided for the legs, follows the principles below:
  - Find prices for legs where the tick size is large.
    - For legs with the same tick size, start with legs where the price spread is small
- Please note, that even if current bid is $0.00 (which is not uncommon for deep-out Options, that they have a BBO of $0.00 - $0.05), we cannot create single trades at $0.00, they must have a price.

1.2.3.1.2.2 Requirements on calculated leg prices

The calculated leg prices must sum up to the given net price for the Combination Order.

The algorithm shall as first priority create prices on tick. To achieve this, two trades may be created in the individual legs which give the calculated average price.

As a last resort, if creating two trades does not give a correct solution, then the algorithm shall create trades off tick prices to reach the Combination Order net price.

1.2.3.1.2.3 Price Calculation Rules

In the following sections, descriptions on how to find price and quantities are described, per defined Combination Order:

- Ratio is a positive value, taken from Reference Data for the defined Combination Order Book. BSRatio (BuySellRatio) is defined as follows:
  - If the leg is sold, BSRatio = -1 * Ratio
  - If the leg is bought, BSRatio = Ratio
  - Ratio is specified per Combination Order leg
- Abbreviations for reference data parameters used in calculation text below:
  - Implied Multiplier (based on Price Quotation Factor*) = IM
    - Leg Prices Outside BBO Allowed = LegPriceOutsideBBO.

Step 1 - Find bid and ask prices to use in coming calculations.

For each leg:

- if neither Bid nor Ask exist (are given in the message), set
  - Bid = Reference – ThSpTicks/2 * ticksize (at reference price)
  - Ask = Reference + ThSpTicks/2 * ticksize (at reference price)
- if Bid exists, but not Ask, set
  - Ask = Bid + ThSpTicks * ticksize (at Bid)
- if Ask exists, but not Bid, set
  - Bid = Lowest Tick

If the extended limit price is inside the calculated Bid - Ask spread, then adjust the spread so that the extended limit price is not violated.

This means that the calculated prices in the legs have to be better than or equal to the extended limit price according to the ranking rules.

Step 2 - Find the lowest possible contribution to the Combination Order price, that would still have leg prices at the spread, by letting buy legs use leg-bid, and selling legs use leg-ask, and the highest possible contribution, by letting buy legs use leg-ask, and selling legs use leg-bid.

- If BSRatio > 0, calculate:
  - Ratio Leg Low = BSRatio * Bid

- Ratio Leg High = BSRatio * Ask

- If BSRatio is not > 0, calculate:
  - Ratio Leg Low = BSRatio * Ask
  - Ratio Leg High = BSRatio * Bid

Step 3 - Find the lowest and highest possible Net price, by summarizing the leg contributions.

For Combination:

- Calculate
  - Combination Bid = SUM(Ratio Leg Low)
  - Combination Ask = SUM(Ratio Leg High)

Step 4 – Decide order to find price.

Sort legs according to the following principles:

- Start with legs where there is no spread (i.e. bid and ask are equal after step 1)
- Then, take legs the in order of their tick size, starting with the largest tick size.
- For legs with the same tick size, take legs in order of their spread, starting with small spreads.

Step 5 – Find Prices for all legs

For each leg, in determined order:

1.2.3.1.2.3.1 A: Find % distance from Combo-Net to Combo-Bid

The basic idea behind the algorithm, is to try to stay with the same distance (in percent) from the Combination Order Bid Price to the Combination Order net for all legs. If pursued, the possibility of finding leg prices within the spread, even for the last legs is improved. There might be other restrictions though that must be taken care of as well.

Calculate:

1. Combination Spread (CombSpr) = Combination Ask – Combination Bid

2a. If CombNet is within CombSpread:

- Percent = (CombNet – Comb Bid)/CombSpr
- LegRatioPrice = Percent * (Ratio Leg High – Ratio Leg Low) + Ratio Leg Low

2b. If CombNet is not within CombSpread:

2b.1. If LegPriceOutsideBBO, calculate

- Percent = (CombNet – Comb Bid)/CombSpr
  - LegRatioPrice = Percent * (Ratio Leg Ask – Ratio Leg Bid) + Ratio Leg Bid

2b.2 Else (*Leg Price is **not** allowed to be outside spread, set it **at** the spread)*

- If Net > Comb Ask
    - LegRatioPrice = Ratio Leg Ask
- Else
    - LegRatioPrice = Ratio Leg Bid

1.2.3.1.2.3.2 B: Round calculated leg price

1. If this is not last leg – round LegRatioPrice to tick size

1.2.3.1.2.3.3 C: Try to find 1 match

Try to see if a rounded leg price (without ratio) to an even tick size is possible to find without pushing the Combination Order Net for the remaining legs to be outside the remaining Combination Order spread:

1. Calculate two possible leg prices, one rounding up and one rounding down:

- LegPricePerContractLow = Round down to closest tick. (example: trunc ((LegRatioPrice / Ratio) / Tick Size, 0) * Tick Size)
- LegPricePerContractHigh = Round up to closest tick. (example: roundUp ((LegRatioPrice / Ratio) / Tick Size, 0) * Tick Size)
- If LegPricePerContractLow is outside the leg spread and LegPricePerContractHigh is inside the spread, then the low price is not a possible choice, and therefore
    - LegPricePerContractLow = LegPricePerContractHigh
- OR if If LegPricePerContractHigh is outside the leg spread and LegPricePerContractLow is inside the spread, then the high price is not a possible choice, and therefore
    - LegPricePerContractHigh = LegPricePerContractLow
- NewCombination Bid = Combination Bid – Ratio Leg Bid
- NewCombination Ask = Combination Ask – Ratio Leg Ask
- NewCombinationMid = (New Combination Ask - New Combination Bid) / 2 (50%)
- CombNetLow = CombNet – LegPricePerContractLow * BSRatio
- CombNetHigh = CombNet - LegPricePerContractHigh * BSRatio

2. To decide which one to use - choose the tick which gives the best "remaining" CombNet, where best means closest to midpoint of CombSpread.

- If CombNetLow is outside New Combination Order Spread and CombNetHigh is inside, use **LegPricePerContractHigh**
- If CombNetHigh outside New Combination Order Spread and CombNetLow is inside, use **LegPricePerContractLow**
- If CombNet before this leg was within spread and now both CombNetLow and CombNetHigh are outside New Combination Order Spread, use algorithm which creates two trades:
    - **Move to algorithm in D for this leg.**
- If CombNet before this leg was outside spread and now both CombNetLow and CombNetHigh are outside, or if both CombNetLow and CombNetHigh are within spread, use the one most favourable for coming calculations, by doing the following:
    - ABSPercentLow = ABS(New Combination Mid - CombNetLow)
    - ABSPercentHigh = ABS(New Combination Mid - CombNetHigh)
        - If (ABSPercentLow > ABSPercentHigh), let LegPricePerContract be = **LegPricePerContractHigh**, otherwise LegPricePerContract = **LegPricePerContractLow**
- Create one trade:
    - Price = LegPricePerContract
    - Quantity = Combination_qty * Ratio * IM

End of calculation for this leg, move to next leg.

Next leg will use the combined spread prices for all legs not yet calculated, and the net price adjusted by the price determined for this leg. This will give the effect that the price of the last leg is more likely to be outside the spread than the others.

- Combination Order Bid = Combination Bid – Ratio Leg Bid

- Combination Order Ask = Combination Ask – Ratio Leg Ask
- LegPricePerContract from above
- CombNet = CombNet – LegPricePerContract * BSRatio

1.2.3.1.2.3.4 D: Create Two Trades 980

1. LegPricePerContract = LegRatioPrice / Ratio

2. LegPrice1= LegPricePerContractLow

3. LegPrice2 = LegPricePerContractHigh

4. Quantity 2 = (LegPricePerContract - LegPrice1) * Ratio * IM * Combination_qty/ tick_size

5. Quantity 2 = Round down to integer value. (example: TRUNC(Quantity 2, 0))

6. Quantity 1 = Ratio * IM * Combination_qty – Quantity 2

End of calculation for this leg

Next leg will use the combined spread prices for all legs not yet calculated, and the net price adjusted by the price determined for this leg. This will give the effect that the price of the last leg is more likely to be outside the spread than the others.

- Combination Bid = Combination Bid – Ratio Leg Bid
- Combination Ask = Combination Ask – Ratio Leg Ask
- CombNet = CombNet – LegPricePerContract * BSRatio

Go back to A for next leg

<u>*Step 6 – Check if leg prices are OK*</u>

If any Leg Price is outside the leg spread, and LegPriceOutsideBBO = False, redo calculation by repeating step 4, but divide all leg tick sizes by 10 first. A prerequisite for this, is that the Trading System has not let any trade match occur if net price was outside combined spread. If net is inside combined spread, the only reason that leg prices are outside leg spread, is that the tick size is too large.

1.2.3.1.2.4 Example 1

BREAK COMBINATION MATCHES INTO SINGLE LEGS – EXAMPLE 1:

Combination Order Book C – Buy 2 X A, Sell 1 X B			
		16.00	100

and the following Order Book legs:

Order Book A (Tick Size = 0.50)			
500	10.00	12.00	500

Order Book B (Tick Size = 0.10)			
500	5.00	6.00	500

Step 1:

Not applicable

Step 2:

Ratio Leg A: Low = 2 X 10 = 20

High = 2 X 12 = 24

Ratio Leg B: Low = -1 X 6 = -6

High = -1 X 5 = -5

Step 3:

The derived Combination Order spread:

(20 – 6) to (24 – 5)

14 – 19 (Combination match price is 16 and therefore in between)

Step 4:

Sequence of the legs:

Leg A first

Leg B second

Step 5A: Start with Leg A

The spread of the derived Combination Order is 5 (19 – 14)

A: Find %-distance from CombNet...

(1) Calculate percentage within the spread.

(16 – 14) / 5 = **40%**

(2a) Use same percentage to find initial price: 40 % X (24-20) + 20 = **21.6**

(2b) Not applicable

5B: Round price

(1) Round price found in step A, to tick if needed

(21.6 / .5 , 0) = 43.2, giving (43 X 0.5) = **21.5**

5C: Try to get one match only

(1) Calculate leg price per contract

21.5 / 2 = **10.75**

Round Low price down and High Price up =>

LowPrice = 10.50

HighPrice 11.00

Combination Bid (excluding A) = 14 – (2*10) = -6

Combination Ask (excluding A) = 19 – (2*12) = -5

Comb Mid (excluding A) = -5.50

CombNetLow = 16 – 2* 10.50 = - 5.00

CombNetHigh = 16 – 2*11 = -6.00

(2) Find which one of tested prices to use

Both CombNetHigh and CombNetLow are inside (actually at) the new Combination Spread (excluding A), 10.50 and 11.00 are both fine.

LowPrice = 10.50 is used according to the algorithm

5D: Algorithm for finding two different prices is not needed in this example

(2) Calculate leg price per contract

21.5 / 2 = ***10.75***

(3) Round to tick if needed

(19.75 / 0.5, 0) = 21.5 giving 21 X 0.5 = ***10.50***

4 (a) Calculate trade prices of Leg A

10.50+ 0.5 = 11

*(10.75 – 10.50) * 2 * 1* 100 / 0.5*

100 @ 11.00

100 @ 10.50

MOVE TO NEXT LEG (FINAL LEG)

Step 5A: Leg B

New adjusted spread is

(21 – 6) to (21 – 5)

(16 – 15) / 1 = 1**00%**

Leg B spread is (-6) - (-5), therefore using 100%, gives a price of:

100 @ 5

and a result of:

Leg A 200 @ 10.50

Leg B 100 @ 5

1.2.3.1.2.5 Performance 1002

Unlike other routines for finding single leg prices, this algorithm only performs a given number of calculations per included leg - it is O(n), which makes it not to heavy from a performance aspect.

1.2.4 Matching - Integrated with Single Orders

Combination Order matching with single Orders is handled as follows:

At each price level, the implied price from single Order Book legs is compared to the price in the Combination Order Book:

- If the implied price is better than the Combination Order Book, the matching is done in the single Order Books;
- If the Combination Order Book price is better the matching, matching is done in the Combination Book; or
- If equal, it's configurable which one is used first.

Matching against single Orders is only made if all Order Books (including the Combination Order Book) are in Continuous Matching during the Open Session.

In addition to matching in the Combination Order Book, when Combination Order matching is integrated with single Orders, the Trading System checks for matches each time the BBO in any of the single Order Books improves its price.

The following examples assume that no Implied Orders are generated. See Implied Generation in Section 1.2.6.

1.2.4.1 Example 1

Given the following Combination Order traded in Net Price:

Buy Instrument A, ratio = 1, Sell Instrument B ratio = 1

Order Book A			
80	$87.60	$88.50	50
50	$87.00	$88.80	100

Order Book B			
40	$80.00	$81.00	110
20	$79.90	$82.00	100

Combination Order Book			
100	$7.50	$8.50	20
50	$7.45	$8.55	20
		$8.75	10

A Combination Order comes in to Buy 120 @ 8.70

Decide if matching should be made against single Order Books or Combination Order Book first (buying at best sell price, selling at best bid):

Calculate net prices by using the formulas specified for the Combination Order price type:

$$B_{uy}N_{et}P_{rice} = B_{uy} - S_{ell}$$

(Please note, that the price available to buy at, is the sell price in the Order Book, and vice versa.**)

Matching against single Books, would give $88.50 - $80.00 = $8.50

Matching against Combination Order Book = $8.50

Prices are equal, configured rules say to start with single Order Books. For all single Order Books, it must be decided how much could be matched at this price level. For A, it could match 50, for B it could match 40 – so, the available quantity at the net price of $8.50 is 40.

After that, matching against single Order Books gives $8.60, so 20 is matched against the Combination Order at $8.50.

After that, matching against single Order Books still gives $8.60, and Combination Order Book gives $8.55 so another 20 can be matched against the Combination Order at $8.55.

Next step, matching against single Order Books still gives $8.60, but matching against Combination Order now gives $8.75 (which cannot be matched against), so, instead,10 will be matched against single Order Books.

No more matching is possible after that execution. The rest of the Combination Order will be stored in the Combination Order Book:

Order Book A			
80	$87.60	$88.80	100
50	$87.00		

Order Book B			
10	$79.90	$81.00	110
		$82.00	100

Combination Order Book			
30	$8.70	$8.75	10
100	$7.50		
50	$7.45		

** Using the single leg Order Books to derive prices for the Combination Order Book would give the prices at which one could buy at $8.50, and the best price at which one could sell as $6.60, i.e. a BBO of **$6.60 - $8.50**

1.2.5 Updating Combination Orders

Participants can update their Combination Orders by specifying the Trading System Trading Order identifier.

Conditions for Combination Orders:

Combination Orders can be Limit or Market Orders and support the following conditions (including what is mandatory and optional).

COMBINATION ORDERS	Limit	Market
Time-in-Force	M	M
DAY	O	O
GTC	O	O
GTD	O	O
FOK	O	O
IOC	O	O
Triggering Conditions	O	O
Last Paid Update	O	O

1.2.6 Implied Generation

Aggregated Implied Orders can be configured to:

1. be generated or

2. not be generated.

When used, aggregated Implied Orders are checked every time:

- when an Order is stored, updated or deleted in the Combination Order Book;
- the best price in any of the single Order Books is changed, either improved by a new Order, or made inferior by an Order execution or Order cancel; or
- the available quantity on best price in any of the single Order Books is changed, either increased by a new Order at best price, or decreased by an Order execution or Order cancel.

When aggregated Implied Orders are used, only one Implied Order will be displayed to the market per leg Order Book and side, with all (aggregated) Implied Order quantity at best price. Note that when aggregated Implied Orders are used, the individual Implied Orders will not be displayed to the market.

Aggregated Implied Orders will only be generated if they are at or improve the BBO (this is not configurable for aggregated Implied Orders).

The aggregated Implied Orders are always ranked last amongst the Orders on the best price, and the ranking of the aggregated Implied Orders does therefore not reflect how the Implied Order will be matched. However, when Orders are matched, the Implied Orders will be matched according to the ranking of the individual Implied Orders, which is according to price for the Implied Order and time for the Combination Order for which the individual Implied Order is derived. Note that the individual Implied Orders (when using aggregated Implied Orders) are only calculated internally within the Trading System, and are not displayed to the market.

There area number of restrictions related to Implied Order generation, and the manner in which Implied Orders are matched in the Trading System, as noted below.

1. Implied Orders are never generated from other Implied Orders. Implied Orders are created from the Orders in the single Order Book and the Combination Order Book.

2. Matching an Implied Order will not impact Implied Orders in the single Order Books. Only Implied Orders, the Combination Orders and single Orders in the Order Books will be matched. Other Implied Orders in single Order Books will be unaffected, even if they have a better price and/or time as compared to other Orders.

3. Implied Orders are only generated and disseminated to the market for the legs of the Combination Order (Implied-Out). Thus, no Implied Orderss are generated in the Combination Order Book (Implied-In).

4. Implied Orders are normally re-generated after the execution of the Order. For some matching plug-in Implied Orders can be re-generated as part of the matching when an Implied Order has been fully matched. The Trading System does not regenerate Implied Orders between individual Orders within a mass quotation transaction. This means that one of the Orders can match the leg of an Implied Order (Order Book B for example), and when a second Order matches the Implied Order (Order Book A for example), the Implied Order can no longer be matched. The Trading System will not match the Implied Order.

6. Implied Orders can be generated from the mass Quotes in the legs of the Combination Order, but only if other Orders exist in the Combination Order Book (since mass quotations cannot be sent for the Combination Order Book).

1.2.6.1 Implied generation examples

1.2.6.1.1 Example Implied Orders from aggregate of Orders at best price from the legs.

The quantity for Implied Orders are calculated from the quantity of the Combination Order and the aggregate of all Orders at best price (excluding other Implieds Order) from the the legs. The minimum of the quantity from the Combination Order, and the aggregate quantity for each leg (at best price), determines the quantity for the Implied Order.

Assume a Combination Order Book Combo = Buy 1 A Sell 1 B (a calendar spread for example):

Buy Combo = Buy A Sell B			
Buy		Sell	
Quantity	Price	Price	Quantity
20	1.000		

Order Book A			
Buy		Sell	
Quantity	Price	Price	Quantity
		99.000	10

Order Book B			
Buy		Sell	
Quantity	Price	Price	Quantity
		98.000	10 (Implied)

Based on the Orders in the Combination Order and the Orders in the single Order Book (A), one Implied Order can be generated in Order Book B. The price becomes 99.00 – 1.000 = 98.000. The quantity is limited by the available quantity in the leg, which is only 10, whereas the quantity in the Combination Order is 20. Thus the quantity becomes 10 for the Implied Order in Order Book B.

Buy Combo = Buy A Sell B			
Buy		Sell	
Quantity	Price	Price	Quantity
20	1.000		

Order Book A			
Buy		Sell	
Quantity	Price	Price	Quantity
		99.000	10
		99.000	5

Order Book B			
Buy		Sell	
Quantity	Price	Price	Quantity
		98.000	15 (Implied)

Adding another Order in Order Book A, at best price, will increase the available quantity in the leg, and increase the quantity of the Implied Order in A to 15. The quantity for the Implied Order is still limited by the available quantity in the leg. .

Buy Combo = Buy A Sell B			
Buy		Sell	
Quantity	Price	Price	Quantity
20	1.000		

Order Book A			
Buy		Sell	
Quantity	Price	Price	Quantity
		99.000	10
		99.000	5
		99.000	15

Order Book B			
Buy		Sell	
Quantity	Price	Price	Quantity
		98.000	20 (Implied)

Adding another Order in Order Book A, at best price, will increase the available quantity in the leg, and increase the quantity of the Implied Order in B to 20. The quantity for the Implied Order is now limited by the available quantity in the Combination Order, which is 20. A total quantity of 30 is available in the leg.

1.2.6.1.2 Example Implied from every Combination Order

One Implied Order can be created for every Combination Order in the Order Book, if there is enough quantity in the leg at best price.

For example, if there is one Combination Order, and several Orders at best price in the the legs, one Implied Order will be created. If there are two Combination Orders, then two Implied Orders can be created and so on, if there is enough aggregated quantity from thethe legs.

Buy Combo = Buy A Sell B			
Buy		Sell	
Quantity	Price	Price	Quantity
20	1.000		
15	1.000		

Order Book A			
Buy		Sell	
Quantity	Price	Price	Quantity
		99.000	10
		99.000	5
		99.000	15

Order Book B			
Buy		Sell	
Quantity	Price	Price	Quantity
		98.000	20 (Implied)
		98.000	10 (Implied)

Based on the two Combinations Orders in the Combo Order Book, two Implied Orders can be created, using the available quantity at best price in the single Order Book A.

A total quantity of 30 contracts is available in the leg. The quantity 20 contracts arematched first with Implied Order, and therefore 10 contract remain available from the leg. The second Implied Order is limited by the remaining quantity in the leg, since the 15 contracts are available in the second Combination Order. The second Implied Order has 10 contracts. See the Order Books above.

Adding another Order in Order Book A, at best price, will increase the available quantity in the leg, and increase the quantity of the second Implied Order in A to 15 contracts. The quantity for the Implied Order is now limited by the available quantity in the Combination Order, which is 15 contracts. The remaining available quantity in leg B is 20 contracts.

The resulting Order Books:

Buy Combo = Buy A Sell B			
Buy			Sell
Quantity	Price	Price	Quantity
20	1.000		
15	1.000		

Order Book A			
Buy		Sell	
Quantity	Price	Price	Quantity
		99.000	10
		99.000	5
		99.000	15
		99.000	25

Order Book B			
Buy		Sell	
Quantity	Price	Price	Quantity
		98.000	20 (Implied)
		98.000	15 (Implied)

When aggregated Implied Orders is used the individual Implied Orders above are not displayed to the market. The aggregated Implied Orders displayed to the market has the following resulting Order Books:

Buy Combo = Buy A Sell B			
Buy			Sell
Quantity	Price	Price	Quantity
20	1.000		
15	1.000		

Order Book A			
Buy		Sell	
Quantity	Price	Price	Quantity
		99.000	10
		99.000	5
		99.000	15
		99.000	25

Order Book B			
Buy		Sell	
Quantity	Price	Price	Quantity
		98.000	35 (Implied)

1.2.6.1.3 Example Implied only from best price in base

An Implied Order will only be generated from the Orders at best price in the the legs.

Other Implied Orders in the leg will not contribute to the leg quantity,because the Implied Order is never generated from other Implied Orders.

Continuing from Example 2.

Adding another Order in Order Book A, with an improved price of 98.990, will decrease the available quantity in the leg for the Implieds Orders (at best price) to only 13 contracts; therefore:

the Implied Order in Order Book B becomes 13 @ 97.990.

There is not any remaining quantity available in Order Book A at best price to generate another Implied Order in Order Book B.

There will not be any Implied Order generated from the second Combination Order; therefore the second Implied Order is removed.

The quantity in the leg at the inferior price level 99.990 will *not* be used when generating Implied Orders.

Buy Combo = Buy A Sell B			
Buy		Sell	
Quantity	Price	Price	Quantity
20	1.000		
15	1.000		

Order Book A			
Buy		Sell	
Quantity	Price	Price	Quantity
		98.990	13
		99.000	10
		99.000	5
		99.000	15
		99.000	25

Order Book B			
Buy		Sell	
Quantity	Price	Price	Quantity
		97.990	13 (Implied)

Assume that another Implied Order in Order Book A has been generated, from another Combination Order = Buy A Sell C, and an Order is in another Order Book, C. The Implied-In Order Book A is 100 @ 98.990 and is the best price. However, the Implied Order is not used when generating Implieds Orders in Order Book B; therfore the Implied Order in Order Book B remains unaffected at 13 @ 97.990.

Buy Combo = Buy A Sell B			
Buy		Sell	
Quantity	Price	Price	Quantity
20	1.000		
15	1.000		

Order Book A			
Buy		Sell	
Quantity	Price	Price	Quantity
		98.990	13
		98.990	100 (Implied) from another combo

Order Book B			
Buy		Sell	
Quantity	Price	Price	Quantity
		97.990	13 (Implied)

1.2.6.1.4 Example Mass quotation can skip Implied Order

Mass quote transaction match against Order Books A and B, and removes the leg in B. The Implied-In Order in Book A will not be matched when matching the second Order.

Buy Order Book C1 = Buy A Sell B			
Buy		Sell	
Qty	Prc	Prc	Qty
		1.000	30

Order Book A			
Buy		Sell	
Qty	Prc	Prc	Qty
		99.000	20 (b) from C1
		99.000	20

Order Book B			
Buy		Sell	
Qty	Prc	Prc	Qty
		98.000	20

The Implied Order in Order Book A is 20 @ 99.000, using the Combination C1 and B. The time stamp for the Implied Order is better than the single Orders in Order Book A, because the single Order was entered after the Implied Order was generated.

Incoming mass quote:

Buy 10 B @ 98.000,

Buy 20 A @ 99.000.

The incoming Order in B is matched and trades 10 contracts of the quantity in Order Book B, leaving 10 contracts in Order Book B.

The remaining Order Book is as follows:

Buy Order Book C1 = Buy A Sell B			
Buy		Sell	
Qty	Prc	Prc	Qty
		1.000	30

Order Book A			
Buy		Sell	
Qty	Prc	Prc	Qty
		99.000	20 (b) from C1

Order Book B			
Buy		Sell	
Qty	Prc	Prc	Qty
		98.000	10

		99.000	20					

The incoming Order in Buy 20 A @ 99.000 is matched. The Trading System will try to allocate 20 contracts to the Implied Order unless there is not enough leg quantity in Order Book B. Accordingly, the Trading System will not match against the Implied Order entirely, and will allocate the Order in Order Book A instead.

After allocation of the second Order, the mass quotation ends, and the re-generation of Implied Orders takes place.

The remaining Order Book is as follows:

Buy Order Book C1 = Buy A Sell B			
Buy		**Sell**	
Qty	**Prc**	**Prc**	**Qty**
		1.000	30

Order Book A			
Buy		**Sell**	
Qty	**Prc**	**Prc**	**Qty**
		99.000	10 (b) from C1

Order Book B			
Buy		**Sell**	
Qty	**Prc**	**Prc**	**Qty**
		98.000	10

If the quantity for the second Order was Buy 30 A @ 99.000, there would be a remaining 10 contracts for the incoming Order at the end of the mass quotation transaction. This quantity would then be matched when the Implied Order is regenerated, thus at this last step, the Implied Order would be matched.

When aggregated Implied Orders are utilized, the individual Implied Orders above will not be displayed to the market via ITCH Market Data Protocol (the Exchange's market data feed). When Orders are matched however, the Implied Orders will be matched according to the ranking of the individual Implied Orders, as indicated above.

The aggregated Implied Order will be ranked last amongst the Orders at the best price, and the ranking of the aggregated Implied Order does not reflect the manner in which the Implied Order will be matched. With aggregated Implied Orders, the single Order Books above will be displayed to the market via the Trading System as follows:

Buy Order Book C1 = Buy A Sell B			
Buy		Sell	
Qty	Prc	Prc	Qty
		1.000	30

Order Book A			
Buy		Sell	
Qty	Prc	Prc	Qty
		99.000	20
		99.000	20 (b) from C1

Order Book B			
Buy		Sell	
Qty	Prc	Prc	Qty
		98.000	20

The aggregated Implied Order is displayed last on best price.

1.2.6.1.5 Example Single Order matching Implied Order

An Order will match against the Implied Order, the Combination Order and the Orders in the legs from which the Implied Order s is generated from. Note however that the Order will not be matched against any Implied Orders in the legs, even if the Implieds Orders have better price or time.

Buy Order Book Combo AB = Buy A Sell B			
Buy		Sell	
Qty	Prc	Prc	Qty
		1.000	50

Buy Order Book Combo BC = Buy B Sell C			
Buy		Sell	
Qty	Prc	Qty	Prc
		0.500	20

Order Book A			
Buy		Sell	
Qty	Prc	Prc	Qty
		99.000	10 (b) from AB

Order Book B			
Buy		Sell	
Qty	Prc	Prc	Qty
		97.500	20 (b) from BC
		98.000	10

Order Book C			
Buy		Sell	
Qty	Prc	Prc	Qty
		97.000	40

The Implied Order in Order Book B, 20 @ 97.500, does not contribute to quantity when generating the Implied Order in Order Book A. The Implied Order in Order Book B is only using quantity from the single Order in Order Book B (base Order Book), 10 @ 98.000.

An aggressive Order Buy 10 A @ 99.000 will match the Implied Order in Order Book A, the Combination Order in Combination AB, and the single Order in Order Book B, 10 @ 98.000. The Implied Order in Order Book B, 20 @ 97.500, is not matched. Note that the Implied Order has both better time and price priority, but will not be matched.

The Order Books after allocation is as follows:

Buy Order Book Combo AB = Buy A Sell B			
Buy		Sell	
Qty	Prc	Prc	Qty
		1.000	40

Buy Order Book Combo BC = Buy B Sell C			
Buy		Sell	
Qty	Prc	Qty	Prc
		0.500	20

Order Book A			
Buy		Sell	
Qty	Prc	Prc	Qty

Order Book B			
Buy		Sell	
Qty	Prc	Prc	Qty
		97.500	20 (b) from BC

Order Book C			
Buy		Sell	
Qty	Prc	Prc	Qty
		97.000	40

1.2.6.1.6 Example Combination Order matching Implieds in two or more Order Books

An aggressive Combination Order can match Implied Orders that exists in different leg Order Books.

Assume the following Orders and Order Books:

Buy Order Book Combo AC = Buy A Sell C			
Buy		Sell	
Qty	Prc	Prc	Qty
		1.000	10

Buy Order Book Combo AB = Buy A Sell B			
Buy		Sell	
Qty	Prc	Prc	Qty
10	1.000		

Buy Order Book Combo BC = Buy B Sell C			
Buy		Sell	
Qty	Prc	Prc	Qty

Order Book A			
Buy		Sell	
Qty	Prc	Prc	Qty
10	98.500	99.000	10

Order Book B			
Buy		Sell	
Qty	Prc	Prc	Qty
		98.000	10 (b) from AB

Order Book C			
Buy		Sell	
Qty	Prc	Prc	Qty
10 (b) from AC	97.500		

The Implied Orders are not over allocated, since they are based on different Orders in Order Book A (one buy and sell side respectively).

Enter Buy 10 Combination BC @ 0.500. This Combination Order will match the existing Implieds Orders in Order Book B (from AB) and in Order Book C (from AC). When matching these Implieds Orders, the Combination Orders and leg Order that the Implied Orders are based on will also be matched. In this case all Orders will be matched.

The resulting Order Books does not contain any remaining Orders:

Buy Order Book Combo AC = Buy A Sell C			
Buy		Sell	
Qty	Prc	Prc	Qty

Buy Order Book Combo AB = Buy A Sell B			
Buy		Sell	
Qty	Prc	Prc	Qty

Buy Order Book Combo BC = Buy B Sell C			
Buy		Sell	
Qty	Prc	Prc	Qty

Order Book A			
Buy		Sell	
Qty	Prc	Prc	Qty

Order Book B			
Buy		Sell	
Qty	Prc	Prc	Qty

Order Book C			
Buy		Sell	
Qty	Prc	Prc	Qty

1.2.6.1.7 Example Aggregated Implied (Customized functionality)

When aggregated Implied Orders are used, only one Implied Order will be displayed to the market per leg Order Book and side, with all (aggregated) implied quantity at best price.

Note that when aggregated Implied Orders are used, the individual Implieds will not be displayed to the market via ITCH Market Data Protocol.

Aggregated Implied Orders will only be generated if they are at or improve the BBO.

The aggregated Implied Orders is always ranked last amongst the Orders on the best price, and the ranking of the aggregated Implied Order does therefore not reflect how the Implied Order will be matched. When Orders are matched however, the Implied Orders will be matched according to the ranking of the individual Implied Orders, which is according to price for the Implied Order and time for the Combination Order upon which the individual Implied Order is based. Note that the individual Implied Orders (when using aggregated Implied Orders) are only calculated internally within the Trading System, and are not displayed to the market via ITCH Market Data Protocol.

Assume the Combination Order Books:

1. C1: Call Spread. Buy 1 C1 = Buy 1 A Sell 1 B
2. C2 : Butterfly. Buy 1 C2 = Buy 1 A Sell 2 B Buy 1 C.

The following available Orders:

1. Buy 25 C1 @ 0.0000 (time 09:00:00. Order Id: 1).
2. Buy 50 B @ 99.6600 (time 09:10:00. Order Id: 2). This creates an aggregate Implied Order in Order Book A: Buy 25 A @ 99.6600 (time 09:00:00 from combo Order C1, Order Id:1. Order Id for Implied Order: x).
3. Buy 5 A @ 99.6600 (time 09:15:00. Order Id 3). This Order is ranked before the Implied Order. The aggregate Implied Order is ranked last amongst the Orders at best price. Note that the aggregate Implied Order does not reflect how the Order will be matched.
4. Buy 5 C1 @ 0.0000 (time 09:20:00. Order Id 4). This updates the aggregated Implied Order in Order Book A: Buy 30 A @ 99.6600 (time 09:00:00 from combo Order C1, Order Id:1. Order Id for Implied: x). The aggregate Implied Order is ranked after the single Order in step 3, because the aggregate Order is ranked last amongst the Orders at best price. Remaining leg quantity for Implied Orders in B is 20.
5. Sell 25 C @ 99.6600 (time 09:30:00. Order Id 5).
6. Buy 40 C2 @ 0.0000 (time 09:40:00. Order Id 6). This updates the Implied Order in Order Book A: Buy 40 A @ 99.6600 (time 09:00:00 from Combination Order C1, Order Id:1. Order Id for Implied: x). Thus the Implied Order is still ranked after the single Order in step 3. Remaining leg quantity for Implied Orders in B is 0.

The resulting Order Book, with the aggregated Implied Order in Order Book A is as follows:

Buy Order Book C2 = Buy A Sell 2 B Buy 1 C			
Buy		**Sell**	
Qty	**Prc**	**Prc**	**Qty**
40	0.0000		

Buy Order Book C1 = Buy A Sell B			
Buy		**Sell**	
Qty	**Prc**	**Prc**	**Qty**
25	0.0000		
5	0.0000		

Order Book A			
Buy		Sell	
Qty	Prc	Prc	Qty
5	99.6600		
40 (b)	99.6600		

Order Book B			
Buy		Sell	
Qty	Prc	Prc	Qty
50	99.6600		

Order Book C			
Buy		Sell	
Qty	Prc	Prc	Qty
		99.6600	25

Assume that an Order hits the Implied Order in Order Book A. The Trading System will then calculate the individual Implied Orders before performing the allocation. The individual Implied will not be displayed to the market.

The individual Implied Orders will be ranked according to the price for the Implied Order and time for the Combination Order.

1.2.6.1.8 Example Aggregated Implied and Ranking of individual Implieds

When aggregate Implied Orders are utilized, increasing the quantity of the Implied Order, because the leg quantity is increased, will not cause the Implied Order to lose time priority.
Assume the Combination Order Books are as follows:

1. C1: Call Spread. Buy 1 C1 = Buy 1 A Sell 1 B

The following Orders are entered (at time $t_1, t_2, \ldots, t_n$, where $t_1 < t_2 < \ldots < t_n$):

1. Buy 25 C1 @ 0.0000 (at t_1).
2. Buy 10 B @ 99.6600 (at t_2). This creates an aggregate Implied Order in Order Book A: Buy 10 A @ 99.6600.
3. Buy 1 A @ 99.6600 (at t_3). This Order ranked after the individual Implied Order (internally within the Trading System), but will be displayed before the aggregate Implied Order, since the aggregate is always displayed last at best price.
4. Buy 10 B @ 99.6600 (at t_4). This will increase the base for the Implied Order, and Implied Order in A is regenerated to Buy 20 A @ 99.6600. Note that the individual Implied Order will not lose time priority in this case, it will still be matched before the single Order from step 3.
5. Sell 20 B @ 99.6600 (at t_5). This will match all the Implied Order quantity but leave the single Order Buy 1 A @ 99.6600 (at t_3) unmatched. This is assuming that Price/Time matching is used for the Order Book.

After step 3 (internally within Trading System):

Buy Order Book C1 = Buy A Sell B			
Buy		Sell	
Qty	Prc	Prc	Qty
25	0.0000 (t1)		

Order Book A			
Buy		Sell	
Qty	Prc	Prc	Qty
10	99.6600 (b)		
1	99.6600 (t3)		

Order Book B			
Buy		Sell	
Qty	Prc	Prc	Qty
		99.6600 (t2)	10

After step 4 (internally within Trading System):

Buy Order Book C1 = Buy A Sell B			
Buy		Sell	
Qty	Prc	Prc	Qty
25	0.0000 (t1)		

Order Book A			
Buy		Sell	
Qty	Prc	Prc	Qty
20	99.6600 (b)		
1	99.6600 (t3)		

Order Book B			
Buy		Sell	
Qty	Prc	Prc	Qty
		99.6600 (t2)	10
		99.6600 (t4)	10

After step 5:

Buy Order Book C1 = Buy A Sell B			
Buy		Sell	
Qty	Prc	Prc	Qty
5	0.0000 (t1)		

Order Book A			
Buy		Sell	
Qty	Prc	Prc	Qty
1	99.6600 (t3)		

Order Book B			
Buy		Sell	
Qty	Prc	Prc	Qty

1.2.6.1.9 Example Aggregated Implieds includes Implieds with match increments (Customized functionality)

Note that for Implied Orders with quantity restrictions (match increment) is included and displayed in the aggregate Implied Orders. If this results in displayed crossed prices, the aggregate Implied Order decreases by one tick.

Assume the Combination Order Book is as follows:

1. C2 : Butterfly. Buy 1 C2 = Buy 1 A Sell 2 B Buy 1 C
2. C3 Call Spread. Buy B Sell C.

The following Orders are entered (at time $t_1, t_2, \ldots, t_n$, where $t_1 < t_2 < \ldots < t_n$):

1. Buy 5 C2 @ 0.0000 (at t_1).
2. Sell 10 A @ 97.0000 (at t_2).
3. Sell 10 C @ 99.0000 (at t_3). A the aggregate Implied Order in B is calculated to to Sell 10/2 @ 98.000.

Buy Order Book C3 = Buy B Sell C			
Buy		Sell	
Qty	Prc	Prc	Qty

Buy Order Book C2 = Buy A Sell 2 B Buy 1 C			
Buy		Sell	
Qty	Prc	Prc	Qty
5	0.0000		

Order Book A			
Buy		Sell	
Qty	Prc	Prc	Qty
		97.0000	10

Order Book B			
Buy		Sell	
Qty	Prc	Prc	Qty
		98.00000	10/2 (b)

Order Book C			
Buy		Sell	
Qty	Prc	Prc	Qty
		99.0000	10

4. Buy 1 B @ 98.0000. This Order can not be matched against the Implied Order, due to the the match increment in the Implied Order,; prices will be crossed. The aggregate Implied Order is decreased by one tick to 98.0050 in this case (for this example only the mimimum trading increment for this Contract is 0.0050).The resulting Order Books are as follows:

Buy Order Book C3 = Buy B Sell C			
Buy		Sell	
Qty	Prc	Prc	Qty

Buy Order Book C2 = Buy A Sell 2 B Buy 1 C			
Buy		Sell	
Qty	Prc	Prc	Qty
5	0.0000		

Order Book A			
Buy		Sell	
Qty	Prc	Prc	Qty
		97.0000	10

Order Book B			
Buy		Sell	
Qty	Prc	Prc	Qty
1	98.00000	98.0050	10/2 (b)

Order Book C			
Buy		Sell	
Qty	Prc	Prc	Qty
		99.0000	10

1.2.6.1.10 Example Aggregated Implied and trade through

An aggregate Implied Order can be traded through, and may not be matched, even if the Implied Order would otherwise match.

For example, assume the Combination Order Book:

1. C2 : Butterfly. Buy 1 C2 = Buy 1 A Sell 2 B Buy 1 C
2. C3 Call Spread. Buy B Sell C.

Assume the following Orders in the Order Books:

Buy Order Book C3 = Buy B Sell C			
Buy		Sell	
Qty	Prc	Prc	Qty
		-1.0000	3

Buy Order Book C2 = Buy A Sell 2 B Buy 1 C			
Buy		Sell	
Qty	Prc	Prc	Qty
5	0.0000		

Order Book A			
Buy		Sell	
Qty	Prc	Prc	Qty
		97.0000	10

Order Book B			
Buy		Sell	
Qty	Prc	Prc	Qty
		98.0000	10/2 (b)
		98.0050	3 (potential Implied)

Order Book C			
Buy		Sell	
Qty	Prc	Prc	Qty
		99.0000	8

The potential Implied Order above is not displayed to the market, and is not included in the aggregate Implied Order, since it is not on best price.

Buy 1 B @ 98.0050. The Order is matched against the internal Implied Order 3 @ 98.0050, which is generated internally within the Trading System. In this case, the Implied Order of 10 /2 @ 98.0000 does not match because of quantity restrictions. The aggregate Implied Order remains unchanged at 10 / 2 @ 98.0000.

The resulting Order Book, with the individual Implied Order (potential Implied Order is not displayed to the market) is as follows:

Buy Order Book C3 = Buy B Sell C			
Buy		**Sell**	
Qty	**Prc**	**Prc**	**Qty**
		-1.0000	2

Buy Order Book C2 = Buy A Sell 2 B Buy 1 C			
Buy		**Sell**	
Qty	**Prc**	**Prc**	**Qty**
5	0.0000		

Order Book A			
Buy		**Sell**	
Qty	**Prc**	**Prc**	**Qty**
		97.0000	10

Order Book B			
Buy		**Sell**	
Qty	**Prc**	**Prc**	**Qty**
		98.0000	10/2 (b)
		98.0050	2 (potential Implied)

Order Book C			
Buy		**Sell**	
Qty	**Prc**	**Prc**	**Qty**
		99.0000	9

1.2.6.2 Regeneration of Implied Orders during aggressive matching

The Trading System shall regenerate Implied Orders during aggressive Order matching if the Implied Order has been completely matched.

This behavior affects performance in the Trading System, since it requires the Trading System to monitor the Implied Orders when a Implied Order has been completely matched.

Note that the Trading System does not regenerate Implied Orders among individual Orders within a mass quotation transaction.

It is implemented for the following Matcher plugins:

- “One by one generate Implied Orders matcher” (for Price/Time allocation).
- “Priority sharing” (for Pro-Rata allocation), with Matching Priority field Pro rata matching value “Round down Pro rata”.

1.2.6.2.1 Example Allocation Price/Time

Example:

A Implied Order of Sell 10 @ 5.00 is available in Order Book B, based on Orders from Order Book A (Sell 10 @ 9.00) and C (Buy 20 @ 4.00).

Order Execution Algorithm is Price/Time.

Buy Combo = Buy A Sell B			
Buy		**Sell**	
Quantity	**Price**	**Price**	**Quantity**
20	4.00		

Order Book A			
Buy		**Sell**	
Quantity	**Price**	**Price**	**Quantity**
		9.00	10
		9.50	10

Order Book B			
Buy		**Sell**	
Quantity	**Price**	**Price**	**Quantity**
		5.00	10 (Implied)
		6.00	10

An aggressive Buy Order of 20 @ MKT is sent into Order Book B.

The Trading System will:

1. match the incoming Order in B with the Implied Order 10 @ 5.00;

2. generate a new Implied Sell 10 @ 5.50 in Order Book B, based on Orders from Order Book A (Sell 10 @ 9.50) and C (now Buy 10 @ 4.00); and

3. matching of the incoming Order in B will then continue (now 10 @ MKT), and trade against the new Implied Order.

The resulting Order Books will be as follows:

Buy Combo = Buy A Sell B			
Buy		Sell	
Quantity	Price	Price	Quantity

Order Book A			
Buy		Sell	
Quantity	Price	Price	Quantity

Order Book B			
Buy		Sell	
Quantity	Price	Price	Quantity
		6.00	10

In the above example, the Combination Order will be matched in its entirety

1.2.6.2.2 Example Allocation Pro-Rata

Example:

A Implied Order of Sell 10 @ 5.00 is available in Order Book B, based on Orders from Order Book A (Sell 10 @ 9.00) and C (Buy 20 @ 4.00).

Matcher Plugin is "Priority sharing" (for Pro-Rata allocation), with Matching Priority field Pro Rata matching value "Round down Pro Rata." The allocation is Pro-Rata, using round down, followed by price/time allocation for remaining quantity.

Buy Combo = Buy A Sell B			
Buy		Sell	
Quantity	Price	Price	Quantity
20	4.00		

Order Book A			
Buy		Sell	
Quantity	Price	Price	Quantity
		9.00	10
		9.50	10

Order Book B			
Buy		Sell	
Quantity	Price	Price	Quantity
		5.00	10 (Implied)
		5.50	15

An aggressive Buy Order of 20 @ MKT is sent into Order Book B.

The Trading System will:

1. ,atch the incoming Order in B with the Implied Order 10 @ 5.00;

2. generate a new Implied Sell 10 @ 5.50 in Order Book B, based on Orders from Order Book A (Sell 10 @ 9.50) and C (now Buy 10 @ 4.00); and

3. matching of the incoming Order in B will then continue (now 10 @ MKT), and trade against the Sell Order 10 @ 5.50 in B, and the new Implied Order (Sell 10 @ 5.50) according to Pro-Rata. The time-stamp for the new Implied Order is after the existing Order in B.

The intermediary Order Book in B (not displayedto the market) will appear as follows:

Buy Combo = Buy A Sell B			
Buy		**Sell**	
Quantity	**Price**	**Price**	**Quantity**
10	4.00		

Order Book A			
Buy		**Sell**	
Quantity	**Price**	**Price**	**Quantity**
		9.50	10

Order Book B			
Buy		**Sell**	
Quantity	**Price**	**Price**	**Quantity**
10	**MKT**	5.50	15
		5.50	10 (Implied)

- The total quantity among the qualified Orders is 25
- The first Order (single Order) is allocated 15/25 * 10 = 6, rounded to 6. Remaining 4 to be allocated to the last Order (the Implied Order).
- The last Order (Implied Order) is allocated 4.

The resulting Order Books is as follows:

Buy Combo = Buy A Sell B			
Buy		**Sell**	
Quantity	**Price**	**Price**	**Quantity**
6	4.00		

Order Book A			
Buy		**Sell**	
Quantity	**Price**	**Price**	**Quantity**
		9.50	6

Order Book B			
Buy		**Sell**	
Quantity	**Price**	**Price**	**Quantity**
		5.50	9
		5.50	6 (Implied)

1.2.6.2.3 *Example No re-generation of Implieds within a mass quotation*

Mass quote transaction hits Order Books B and A, thus removing the leg in B. The Implied Order is *not* re-generated between the allocation of B and A.

Buy Order Book C1 = Buy A Sell B			
Buy		**Sell**	
Qty	**Prc**	**Prc**	**Qty**
		1.000	30

Order Book A			
Buy		**Sell**	
Qty	**Prc**	**Prc**	**Qty**
		99.000	20 (b) from C1
		99.000	20

Order Book B			
Buy		**Sell**	
Qty	**Prc**	**Prc**	**Qty**
		98.000	20

The Implied Order in Order Book A is 20 @ 99.000, using the Combination C1 and B. The time stamp for the Implied Order is better than the single Orders in Order Book A, because the single Order was entered after the Implied Order was generated.

Incoming mass quote:

Buy 10 B @ 98.000,

Buy 20 A @ 99.000.

The incoming Order in B is matched, A trades 10 of the quantity in the Order Book B, leaving quantity 10 in Order Book B. The Implied Order is however not re-generated.

The remaining Order Book is as follows:

Buy Order Book C1 = Buy A Sell B			
Buy		Sell	
Qty	Prc	Prc	Qty
		1.000	30

Order Book A			
Buy		Sell	
Qty	Prc	Prc	Qty
		99.000	20 (b) from C1
		99.000	20

Order Book B			
Buy		Sell	
Qty	Prc	Prc	Qty
		98.000	10

The incoming Order in Buy 20 A @ 99.000 is matched. The Trading System will try to allocate 20 to the Implied Order, but, due to insufficient quantity in leg Order Book B, it will not match the Implied Order in its entirely, and instead allocate the Order in Order Book A.

After allocation of the second Order, the mass quotation ends, and the re-generation of Implied Orders takes place.

The remaining Order Book is as follows:

Buy Order Book C1 = Buy A Sell B			
Buy		Sell	
Qty	Prc	Prc	Qty
		1.000	30

Order Book A			
Buy		Sell	
Qty	Prc	Prc	Qty
		99.000	10 (b) from C1

Order Book B			
Buy		Sell	
Qty	Prc	Prc	Qty
		98.000	10

If the quantity for the second Order was Buy 30 A @ 99.000, there would be a remaining quantity 10 for the incoming Order at the end of the mass quotation transaction. This quantity would then be matched when the Implied Order is regenerated, thus at this last step, the Implieds Order would be matched.

When aggregated Implied Order is used the individual Implied Order above will not be displayed to the market.

The aggregated Implied Order is always ranked last among the Orders at the best price, and the ranking of the aggregated Implied Order does therefore not reflect how the Implied Order will be matched.

The aggregated Implied Orders displayed to the market has the following original Order Books:

Buy Order Book C1 = Buy A Sell B			
Buy		Sell	
Qty	Prc	Prc	Qty
		1.000	30

Order Book A			
Buy		Sell	
Qty	Prc	Prc	Qty
		99.000	20
		99.000	20 (b) from C1

Order Book B			
Buy		Sell	
Qty	Prc	Prc	Qty
		98.000	20

1.2.6.3 Net Price

Combination Orders traded in Net Price trade at the sum of all the leg prices. Therefore, if the price of the Combination Order is given, then the prices of the legs can be calculated one leg at a time.

Combination Order 1
ABC (Buy A, Sell B, Buy C), Ratio = 1
Buy 60 @ 47.00

Order Book A			
100	$10.00	$12.00	100

Order Book B			
100	$30.00	$33.00	100

Order Book C			
100	$65.00	$66.00	100

Combination Order is not executable against the single Order Books (available net price is 48)

$$\mathbf{B}_{uy}\mathbf{N}_{et}\mathbf{P}_{rice} = \mathbf{B}_1 + \mathbf{B}_2 + \ldots + \mathbf{B}_x - \mathbf{S}_1 - \mathbf{S}_2 \ldots - \mathbf{S}_x \implies$$

$$\mathbf{BNP}_{ABC} = \mathbf{B}_A + \mathbf{B}_C - \mathbf{S}_B$$

$$B_A = BNP_{ABC} - B_C + S_B$$

$$S_B = B_A + B_C - BNP_{ABC}$$

$$B_C = BNP_{ABC} - B_A + S_B$$

Using B and C for generating Implied Orders in A gives 47 – 66 + 30 = 11, i.e. we can buy A at 11, and still get a net of 47.

Using A and C generating Implied Order s in B gives 66 + 12 - 47 = 31, i.e. we can sell B at 31, and still get a net of 47.

Using A and B generating Implied Order s in C gives 47 - 12 + 30 = 65, i.e. we can buy C at 65, and still get a net of 47.

Please note that the calculated prices for the Implied Order s, must be rounded to the given tick size for the single Order Books. Rounding is then always made so that the Limit Order price of the Combination Order is not violated.

The following Implied Orders are therefore calculated:

Order Book A			
60 (b1)	$11.00	$12.00	100
100	$10.00		

Order Book B			
100	$30.00	$31.00	60(b1)
		$33.00	100

Order Book C			
100	$65.00	$66.00	100
60 (b1)	$65.00		

where the highlighted Orders are Implied Orders.

1.2.6.4 Over Commitment

Over commitment means that several Implied Orders, in different Order Books, use the same leg quantity. It is an "over commitment", since all Implied Orders cannot be executed at the same time (by a mass quote transaction for example).

Total over commitment means that the same base quantity is used for several Implied Orders in the same Order Book. The Implied Orders are generated from Orders in the same Combination Order Book. It is a "total over commitment." since all Implied Orders can not be executed at the same time (by a single Order).

Thus over commitment indicates more liquidity in the Implied Order Books than can actually be matched.

The Trading System permits "over commitment," but does not permit "total over commitment" of quantity for Implied Orders. The two following rules applies:

1. When generating Implied Orders for different single Order Books which have the same base leg in common, the leg quantity will be utilized for all Implieds Orders. This is an example of "over commitment"which may be applied.

2. When generating Implied Order s for the different Combination Orders within one Combination Order Book, the leg quantity will only be used once. The leg quantity will be shared between the Combination Orders, according to Price/Time for the Combination Orders. One Implied Order can be created for every Combination Order, even if the Combination Order is not on best price, if there is enough quantity available from the leg Orders from the best price

(excluding quantity from other Implied Orders). Therefore all Implied Orders in the Order Book can be matched by a single Order. This is an example of "total over commitment," which must not be applied.

When aggregated Implied Order are used, the individual Implied Orders above are not displayed to the market via ITCH Market Data Protocol. Only one aggregated Implied Order on best price will be displayed to the market via the Trading System.

The leg quantity will be shared between different Combination Order Books according to:

1. price of the calculated Implieds; and

2. time of the Combination Order used for the Implied Order.

1.2.6.4.1 Example Over Commitment

The Trading System allows over commitment of quantity for Implieds Orders. When generating Implied Orders for different Combinations Order Books which have the same leg in common, the leg quantity will be used for all Implieds Orders.

This will indicate more liquidity in the Implied Order Books.

Assume a Combination Order Book Buy AB = Buy 1 A Sell 1 B.

Assume a Combination Order Book Buy AC = Buy 1 A Sell 1 C.

Buy Order Book Combo AC = Buy A Sell C			
Buy		Sell	
Qty	Prc	Prc	Qty
10	1.000		

Buy Order Book Combo AB = Buy A Sell B			
Buy		Sell	
Qty	Prc	Prc	Qty
10	1.000		

Order Book A			
Buy		Sell	
Qty	Prc	Prc	Qty
		99.000	10

Order Book B			
Buy		Sell	
Qty	Prc	Prc	Qty
		98.000	10 (b) from AB

Order Book C			
Buy		Sell	
Qty	Prc	Prc	Qty
		98.000	10 (b) from AC

One Implied Order is created in Order Book B and one Implied in Order Book C. Both Implied Orders use the same leg quantity in Order Book A, which is 10. Therefore if any of the Implied Orders would be fully traded, the other Implied Order would no longer have any available leg quantity, and would therefore be removed. Thus the quantity in the Implied Orders is over committed since it is not possible to trade the indicated quantity, if all Implied Orders would be matched at the same time.

1.2.6.4.2 Example Total over commitment

The Trading System does not allow total over commitment. In total over commitment, the leg quantity can be used many times to create several Implied Orders from several Combination Orders for one Combination Order Book.

Buy Order Book Combo AB = Buy A Sell B			
Buy		Sell	
Qty	Prc	Prc	Qty
10	1.000		
10	1.000		
10	0.990		

Order Book A			
Buy		Sell	
Qty	Prc	Prc	Qty
		99.000	15

Order Book B			
Buy		Sell	
Qty	Prc	Prc	Qty
		98.000	10 (b) from AB
		98.000	10 (b) from AB
		98.010	10 (b) from AB

The second and third Implied Orders are examples of total over committed quantity, because the same leg quantity is used for all Implied Orders, based on the same Combination Order Book. Note again that total over commitment of Implied Orders is not supported.

In the Trading System, the following Implied Orders will be created:

Buy Order Book Combo AB = Buy A Sell B			
Buy		Sell	
Qty	Prc	Prc	Qty
10	1.000		
10	1.000		
10	0.990		

Order Book A			
Buy		Sell	
Qty	Prc	Prc	Qty
		99.000	15

Order Book B			
Buy		Sell	
Qty	Prc	Prc	Qty
		98.000	10 (b) from AB
		98.000	5 (b) from AB

However, if more leg quantity was available, the Trading System would create more Implied Orders.

Buy Order Book Combo AB = Buy A Sell B			
Buy		Sell	
Qty	Prc	Prc	Qty
10	1.000		
10	1.000		
10	0.990		

Order Book A			
Buy		Sell	
Qty	Prc	Prc	Qty
		99.000	30

Order Book B			
Buy		Sell	
Qty	Prc	Prc	Qty
		98.000	10 (b) from AB
		98.000	10 (b) from AB
		98.010	10 (b) from AB

When aggregated Implied Orders is used the individual Implied Orders above are not displayed to the market. Only one aggregated Implied Order on best price will be displayed to the market:

Buy Order Book Combo AB = Buy A Sell B			
Buy		Sell	
Qty	Prc	Prc	Qty
10	1.000		
10	1.000		
10	0.990		

Order Book A			
Buy		Sell	
Qty	Prc	Prc	Qty
		99.000	30

Order Book B			
Buy		Sell	
Qty	Prc	Prc	Qty
		98.000	30 (b) from AB

1.2.6.5 Quantity Restrictions on the Implied Order

An Implied Order may have quantity restrictions if the Combination Order Books have different ratios. -

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1.2.6.5.1 - Example Implied Order with quantity restrictions

A Implied Order with quantity restrictions:
Assume that Buy 1 Combination Order = Buy 1 A Sell 2 B Buy 1 C (a butterfly strategy).

The tick size for the Order Books is 0.010. The number of decimals is 3.

Buy Order Book Combination Order = Buy 1 A Sell 2 B Buy 1 C									
Buy Side					Sell Side				
Comment	Time	Order Id	Quantity	Price	Price	Quantity	Order Id	Time	Comment
					1.000	10	1	09:00:00	

Order Book A									
Buy Side					Sell Side				
Comment	Time	Order Id	Quantity	Price	Price	Quantity	Order Id	Time	Comment
	09:00:10	2	10	97.000					

Order Book C									
Buy Side					Sell Side				
Comment	Time	Order Id	Quantity	Price	Price	Quantity	Order Id	Time	Comment
	09:00:20	3	10	99.000					

This will create an internal Implied Order in Order Book B with a time stamp when the Implied Order is generated, which in this case is the time when the Order in C is entered (09:00:20). The quantity for the Implied Order will be 20 (with quantity restriction 2), because the ratio for the Combination Order is 1:2:1. Thus the maximum quantity of 20 can be matched in Order Book B, but it must be matched in multiples of the quantity 2 (2,4, 6, ..., 20), for the Implied Order.

The price for the Implied Order is calculated from the leg Orders in A and C, and from the Combination Order:

Buy Net Price = BNP = Buy Legs – Sell Legs = A + C – 2* B.

Hence 2* B = A + C – BNP.

Thus B = (A + C - BNP) / 2 = (97.000 + 99.000 – 1.000) / 2 = 195.000 / 2 = 97.500. Thus the price for the Implied Order is on-tick.

Note that this Implied Order is not disseminated to the market via ITCH Market Data Protocol.

Order Book B									
Buy Side					Sell Side				
Comment	Time	Order Id	Quantity	Price	Price	Quantity	Order Id	Time	Comment
	09:00:20	1	20 / 2 (internal Implied)	97.500					

1.2.6.6 Single Price Limits

An Order used as a base for an Implied Order, will never surpass a given Limit Order price, and, therefore, a generated Implied Order must also never surpass the base Limit Order price.

1.2.6.7 Executing Implieds

Implied Orders are ranked and matched the same as other Orders in the Trading System .

When an Implied Order is executed, it will be treated the same as other passive Orders. The other legs of the Combination Order will be matched against their respective Order Books as aggressive Orders.

1.2.6.7.1 Off Tick Executions due to different tick size

Passive Implied Orders can be executed off trading tick. This can occur when Combination Order Books trade at smaller tick sizes than their single legs.

When two (or more) passive Orders in the Combination Order Books at different prices generate Implied Orders at the same price due to the tick size rounding, the Implied Order from the better priced Combination Order will be ranked ahead of the Order Book leg. At execution, the price of the Combination Order is used to calculate an off tick price of the single leg, as opposed to using a rounded value. The Implied Order will be displayed rounded, however, will be executed off tick.

If the passive Implied Order is executed off tick, the rounding benefit goes to the aggressive Order (i.e. gets a better price than expected).

1.2.6.7.2 Off Tick Execution for Implieds with Quantity Restriction

Off tick trading can also occur for an Implied Order, if the Combination Order legs have different ratios (e.g. an Inter-Commodity Spread). Thus for a Implied Order for a leg with ratio greater than 1, the calculated price can be off tick. This Implied Order has a quantity restriction, is not disseminated. See the section Quantity Restrictions on the Implied Order." The Implied Order can still be executed off tick.

1.2.6.7.2.1 Example Implied on off tick price

A Implied Order with quantity restrictions may be off tick, and will not match through the Order Book.

Assume that the Buy 1 Combination Order = Buy 1 A Sell 2 B Buy 1 C.

The tick size for the Order Books is 0.010. The number of decimals is 3.

Buy Order Book Combination Order = Buy 1 A Sell 2 B Buy 1 C									
Buy Side					Sell Side				
Comment	**Time**	**Order Id**	**Quantity**	**Price**	**Price**	**Quantity**	**Order Id**	**Time**	**Comment**
					1.000	10	1	09:00:00	

Order Book A									
Buy Side					Sell Side				
Comment	**Time**	**Order Id**	**Quantity**	**Price**	**Price**	**Quantity**	**Order Id**	**Time**	**Comment**
	09:00:10	2	10	97.000					

Order Book C									
Buy Side					Sell Side				
Comment	**Time**	**Order Id**	**Quantity**	**Price**	**Price**	**Quantity**	**Order Id**	**Time**	**Comment**
	09:00:20	3	10	99.010					

This will create a internal Implied Order in Order Book B, with a time stamp when the Implied Order is generated, which in this case is the time when the Order in C is entered (09:00:20). The quantity for the Implied Order will be 20 (with quantity restriction 2), because the ratio for the Combination Order is 1:2:1. Thus the quantity of 20 can be matched in Order Book B, but it must be matched in multiples of the quantity 2, for the Implied Order.

The price for the Implied Order is calculated from the leg Orders in A and C, and from the Combination Order:

Buy Net Price = BNP = Buy Legs – Sell Legs = A + C – 2* B.

Hence 2* B = A + C – BNP.

Thus B = (A + C - BNP) / 2 = (97.000 + 99.010 – 1.000) / 2 = 197.010 / 2 = 97.505.

Thus the price for the Implied Order is off tick. Since there are 3 decimals used in the price, the off tick price will be represented in number format, and no further rounding of the Implied Order price is required.

The Order ID is 1, based on the Combination Order.

Note that this Implied Order is not disseminated to the market or in the Order Book.

Order Book B									
Buy Side					**Sell Side**				
Comment	**Time**	**Order Id**	**Quantity**	**Price**	**Price**	**Quantity**	**Order Id**	**Time**	**Comment**
Price is off tick	09:00:20	1	20 / 2 (internal Implied)	97.505					

Enter a non-Implied Order Buy 1 B @ 97.500. This Order is at a inferior price than the Implied Order. It is not possible to enter a normal Order at 97.505, since it is off tick.

Order Book B									
Buy Side					**Sell Side**				
Comment	**Time**	**Order Id**	**Quantity**	**Price**	**Price**	**Quantity**	**Order Id**	**Time**	**Comment**
Price is off tick	09:00:20	1	20 / 2 (internal Implied)	97.505					
	09:00:30	4	1	97.500					

Enter Sell 1 B @ MKT. This Order will try to match the Implied Order, however, due to the quantity restriction of 2, the Implied Order will not be matched.

Instead the Order is matched at the next price level, 97.500, which is an inferior price.

The Order Book after allocation is as follows:

Order Book B									
Buy Side					**Sell Side**				
Comment	**Time**	**Order Id**	**Quantity**	**Price**	**Price**	**Quantity**	**Order Id**	**Time**	**Comment**
Price is off tick	09:00:20	1	20 / 2 (internal Implied)	97.505					

1.2.6.7.2.2 Example Implied on off tick price rounded to inferior price

An Implied Order with quantity restrictions can be off tick, and may be rounded to an inferior price if the number of decimals is too low to represent the price.

Assume that the Buy 1 Combination Order = Buy 1 A Sell 2 B Buy 1 C.

The tick size for the Order Books is 0.005. The number of decimals is 3.

Buy Order Book Combination Order = Buy 1 A Sell 2 B Buy 1 C									
Buy Side					Sell Side				
Comment	Time	Order Id	Quantity	Price	Price	Quantity	Order Id	Time	Comment
					1.000	10	1	09:00:00	

Order Book A									
Buy Side					Sell Side				
Comment	Time	Order Id	Quantity	Price	Price	Quantity	Order Id	Time	Comment
	09:00:10	2	10	97.000					

Order Book C									
Buy Side					Sell Side				
Comment	Time	Order Id	Quantity	Price	Price	Quantity	Order Id	Time	Comment
	09:00:20	3	10	99.005					

This will create an internal Implied Order in Order Book B, with a time stamp when the Implied Order is generated, which in this case is the time when the Order in C is entered (09:00:20). The quantity for the Implied Order will be 20 contracts (with quantity restriction 2), because the ratio for the Combination is 1:2:1. The 20 contracts will be matched in Order Book B, but it will also be matched in multiples of the quantity 2 for the Implied Order.

The price for the Implied Order is calculated from the leg Orders in A and C, and from the Combination Order:

Buy Net Price = BNP = Buy Legs – Sell Legs = A + C – 2* B.

Hence 2* B = A + C – BNP.

Thus B = (A + C - BNP) / 2 = (97.000 + 99.005 – 1.000) / 2 = 197.010 / 2 = 97.5025.

Thus the price for the Implied Order is off tick. However since there are 3 decimals in the price, the off tick price will not be represented in the number format.

Since there are only 3 decimals in the price format, the Implied Order price is truncated to 97.502, an inferior price.

If the Order had been a Sell Order, then the price will be rounded up to 97.503, an inferior price. Note that there is no valid tick which follows, thus the Implied Order price remains off tick.

The Order ID is 1, based on the Combination Order.

Note that this Implied Order is not disseminated to the market via ITCH Market Data.

Order Book B									
Buy Side					**Sell Side**				
Comment	**Time**	**Order Id**	**Quantity**	**Price**	**Price**	**Quantity**	**Order Id**	**Time**	**Comment**
Price is off tick	09:00:20	1	20 / 2 (internal Implied)	97.502					

1.2.6.8 Boundaries for Implied Order Generation

Regarding Implieds:

- Implied Orders are not generated for Quotes (when quoting in the Combination Order Book itself);
- Implied Orders are only generated, using the best single prices as a base; and
- Implied Orders are never used as a base for other Implied Orders.

Exhibit B

New text is underlined; deleted text is stricken.

NASDAQ OMX Futures Exchange – Rules

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Chapter IV Trading System

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Section 4 Acceptable Orders

Orders entered into the Trading System for display and/or execution, as appropriate, are executable against marketable contra-side Orders in the Trading System.

(a) Types of Orders accepted by the Trading System are as follows:

(i) – (vii) No Change

(viii) Combination Orders.

(i) Combination Orders or "Strategies" will be traded in a separate Order Book pursuant to the Rules in Chapter IV, Section 5. Combination Orders may be originated (adding Expiries, Contracts and trading symbols), by either: (i) the Exchange; or (ii) a Futures Participant or its Authorized Traders or Authorized Customers. Combination Orders may execute against other Combination Orders or they may execute against the respective legs of Orders within the Order Book. Combination Orders shall not update the prices of the respective legs of such Combination Orders in their respective Order Book. The Exchange will disseminate Combination Orders through ITCH and FIX protocols.

(ii) Types of Combination Orders accepted by the Trading System, which may not exceed four legs, are as follows:

(a) – (f) No Change.

(g) Conversions are ~~buying~~ <u>selling</u> a call Option and ~~selling~~ <u>buying</u> a put Option of the same underlying, expiration and strike at the same time as buying the underlying, or an underlying future.

(h) Reversals are ~~selling~~ <u>buying</u> a call Option and ~~buying~~ <u>selling</u> a put Option of the same underlying, expiration and strike at the same time as selling the underlying short, or selling an underlying future.

(i) – (k) No Change.

(ix) No Change.

(b) No Change.

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Exhibit C

New text is underlined; deleted text is stricken.

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3.10 Strategies – Combination Orders

The Trading System supports the trading of Strategies also referred to as Combination Orders, which will trade in a separate Order Book. The Exchange may list Futures and/or Options combinations for trading, and users may create their own tailor made combination (TMC) for Futures and/or Options combinations not already defined in the Trading System. Market participants may submit GFD Combination Orders that, if matched, will simultaneously trade the referenced single leg Instruments according to the specified strategy without execution risk. Once created intraday, a TMC Order Book is visible to the entire market and lives throughout the trading day.

Representative types of Combination Orders accepted by the Trading System, which may be comprised of a minimum of two, but not exceed four, legs are as follows:

- **Buy and Write (a.k.a. Covered Call)** – Buy a Futures Contract, and write call Options.
- **Call (Put) Spreads** – Buy and sell two call (put) Options of the same underlying and expiration but with different strikes.
- **Calendar (Horizontal) Spreads** – Buy and sell two call (put) Options of the same underlying and strike, but with different expirations.
- **Straddles** – Buy a call Option and a put Option of the same underlying, expiration and strike.
- **Strangles** – Buy a call Option and a put Option of the same underlying and expiration, but with different strikes.
- **Conversion** – ~~Buy~~Sell a call Option and ~~sell~~ buy a put Option of the same underlying, expiration and strike at the same time as buying the underlying, or an underlying Future.
- **Reversal** - ~~Sell~~ Buy a call Option and ~~buy~~ sell a put Option of the same underlying, expiration and strike at the same time as selling the underlying short, or selling an underlying Future.
- **Butterfly Spread** – A Contract strategy consisting of three legs either for Futures or Options. Butterfly Option Spreads consist of three put and/or call Contracts. Butterfly Futures Spreads consist of three Contracts.
- **Condor and Iron Condor Spreads** – A Contract strategy consisting of four legs. Condor Options Spreads consist of four Options Contracts (all put or all call Contracts). Condor Futures Spreads consist of four Futures Contracts. Iron Condor Options Spreads consist of four Options Contracts (two put and two call Contracts).
- **Intra-Commodity (Time) Spread** – Combinations may be formed by buying and selling two Futures of the same underlying, but with different expirations. Combinations may be formed by two different Future Expiries (NFX WTI Crude Oil Financial Futures, March versus June contract).

- The price ratio for the underlying legs will be configured to an integer of one. There will be no change to the trading tick size.

- **Inter-Commodity Spread** – Combinations may be formed of two or three different underlying Futures Contracts (NFX WTI Crude Oil Financial Futures versus NFX RBOB Gasoline Financial Futures versus NFX Heating Oil Financial Futures "Crack Spread").
    - The price ratio for the underlying legs will be configured to an integer of less than one, but rounded to four decimal places to the right from an initial calculation of fourteen places. Accordingly, the minimum price interval for a respective leg price is one hundredth of a cent ($0.0001) versus its outright leg trading tick which may be 0.01.

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