Cboe®

Summary Product Specifications Chart
for S&P 500 Variance Futures

CONTRACT NAME:	S&P 500 Variance Futures
LISTING DATE:	December 10, 2012
DESCRIPTION:	S&P 500 Variance futures are exchange-traded futures contracts based on the realized variance of the S&P 500 Composite Stock Price Index (S&P 500).The final settlement value for the contract will be determined based on a standardized formula for calculating the realized variance of the S&P 500 measured from the time of initial listing until expiration of the contract. The standard formula inputs for discount factor and daily interest rate are determined by the Exchange.
CONTRACT SIZE:	The contract multiplier for the S&P 500 Variance futures contract is $1 per variance unit. One contract equals one variance unit.
TRADING HOURS:	8:30 a.m. - 3:15 p.m. (Chicago time).
CONTRACT MONTHS:	The Exchange may list contract months on S&P 500 Variance futures that correspond to the listed contract months for S&P 500 Index options listed on Chicago Board Options Exchange, Incorporated (CBOE).
TICKER SYMBOL:	VA
PRICING QUOTATION:	The S&P 500 Variance futures contract is quoted in terms of volatility points (e.g., 25.65) and vega notional (e.g., 100,000 vega). At the close of trading (or soon thereafter when the current day's realized variance of the S&P 500 is determined by CFE using the daily S&P 500 closing value provided to CFE by the index calculator) [trade execution], price is converted from volatility points to an adjusted futures price (rounded to the nearest 0.0001). On each trading day, the closing value of the S&P 500 for that day will be included in the price conversion as a realized observation. If the index calculator adjusts the closing value of the S&P 500 after the Exchange receives it, the Exchange will not adjust the realized variance determined for a given day (unless the Exchange determines otherwise). Because the adjusted futures price is converted at the end of day, intraday quotes will generally be expected to be priced solely to account for implied volatility. Additionally, at the close of trading, quantity is converted from vega notional to variance units. The conversion formulas are as follows: *Volatility Points to Adjusted Futures Price:* $$F_t = DF(t,T)(k - k_0) - ARMVM + 1000$$ Where, $DF(t,T) = $ OIS discount factor from time t to maturity T. $$k = \frac{252}{N_e - 1} \times \left(\left(volatility\ strike^2 \times \frac{(N_e - 1 - n)}{252} \right) + \left(\sum_{i=1}^{n} R_i^2 \times 10{,}000 \right) \right)$$ $k_0 = $ Initial Variance Strike – see below ARMVM = Accumulated Return on Modified Variation Margin - see below

	$N_e =$ Number of expected S&P 500 values needed to calculate daily returns from the date the contract is listed until settlement. n = Number of returns to date, which includes the return through the close of trading each trading day. $$R_j = \ln\left(\frac{P_{j+1}}{P_j}\right)$$ *Vega Notional to Variance Units:* $$\text{Variance Units*} = \frac{\text{Vega Notional}}{2 \times \text{Volatility Strike}} \times \frac{N_e - 1}{N_e - 1 - n}$$ Where, $N_e =$ Number of expected S&P 500 values needed to calculate daily returns from the date the contract is listed until settlement. n = Number of returns to date, which includes the return through the close of trading each trading day. *The number of variance units will be rounded to the nearest integer.
MINIMUM PRICE INTERVALS:	The minimum price interval is .05 volatility points.
MINIMUM QUOTE AND ORDER SIZES:	The minimum quote size and the minimum order size for the S&P 500 Variance futures contract is 1,000 vega notional and all quotes and orders must be in multiples of 1,000 vega notional. The sizes of quotes, Orders and trades in S&P 500 Variance futures are expressed and displayed in notional equivalent units of 1,000 vega notional. For example, a quote, Order or trade size of 1 has a size of 1,000 vega notional, and a quote, Order or trade size of 3 has a size of 3,000 vega notional. Quote, Order and trade expression and display in notional equivalent units of 1,000 applies to all trading in S&P 500 Variance futures, including Block Trades and Exchange of Contract for Related Position transactions.
CROSSING:	CFE Rule 2302(h). Crossing Two or More Original Orders. The eligible size for an original Order that may be entered for a cross trade with one or more other original Orders pursuant to Rule 407 is a Contract amount equal to 1,000 vega notional. The Trading Privilege Holder or Authorized Trader, as applicable, must expose to the market for at least five seconds under Rule 407(a) at least one of the original Orders that it intends to cross.
PRE-EXECUTION DISCUSSIONS:	CFE Rule 2302(m). Pre-execution Discussions. The Order Exposure Period under Policy and Procedure IV before an Order may be entered to take the other side of another Order with respect to which there has been pre-execution discussions is five seconds after the first Order was entered into the CFE System.
EXCHANGE OF CONTRACT FOR RELATED POSITION TRANSACTIONS:	CFE Rule 2302(j). Exchange of Contract for Related Position transactions, as set forth in Rule 414, may be entered into with respect to S&P 500 Variance futures contracts. Any Exchange of Contract for Related Position transaction must satisfy the requirements of Rule 414 and must be for a minimum order size of 1,000 vega notional.
BLOCK TRADES:	CFE Rule 2302(k). Pursuant to Rule 415(a)(i), the minimum Block Trade

	quantity for the S&P 500 Variance futures is a contract amount equaling 50,000 vega notional if there is only one leg involved in the trade. If the Block Trade is executed as a spread order, one leg must meet the minimum Block Trade quantity for the S&P 500 Variance futures contract and the other leg of the spread is required to have a contract amount with a minimum size of 25,000 vega notional. A Block Trade may not be executed in S&P 500 Variance futures as a strip. Block Trades in S&P 500 Variance future stub positions are not permitted. The minimum price increment for a Block Trade in the S&P 500 Variance futures contract is 0.01 volatility index points.
STUB TRADING:	A stub position in the S&P 500 Variance futures contract is a position that when converted from variance units (number of contracts) to vega notional is equal to an amount that is less than 1 notional equivalent of 1,000 vega notional. The provisions of Rule 2302 apply to trading in S&P 500 Variance future stub positions, except as modified here. The sizes of Orders and trades in S&P 500 Variance future stub positions are expressed and displayed in variance units (number of contracts). Upon receipt of an Order for an S&P 500 Variance stub position, the Exchange will convert the number of variance units (number of contracts) to vega notional and if that amount exceeds 1 notional equivalent of 1,000 vega notional, the Order will be automatically rejected or canceled back to the sender. Orders for S&P 500 Variance future stub positions will only interact with other Orders for S&P 500 Variance future stub positions and will not interact with non-stub positions in the S&P 500 Variance futures contract. Good-'til-Canceled Orders, Good-'til-Date Orders, and spread trades are not permitted in S&P 500 Variance future stub positions. Market Orders for S&P 500 Variance future stub positions will not be accepted by the Exchange outside of trading hours for the S&P 500 Variance futures contract. Any Market Orders for S&P 500 Variance future stub positions received by the Exchange outside of trading hours for the S&P 500 Variance futures contract will be automatically rejected or canceled back to the sender.
NO BUST RANGE:	CFE Rule 2302(l). Pursuant to Rule 416 the Exchange error trade policy may only be invoked for: (i) a trade price that is greater than 10% on either side of the market price, quoted in volatility points, of the applicable S&P 500 Variance futures contract (referred to as trade price errors), and (ii) an error in the calculation of the number of variance units or the futures converted contract price for the trade (referred to as a standard formula input error). In accordance with Policy and Procedure III, for trade price errors, the Trade Desk will determine what the true market price for the relevant Contract was immediately before the potential error trade occurred. For stub and non-stub positions in S&P 500 Variance futures, the true market price will be determined by reference to non-stub positions in S&P Variance futures and not

	by reference to S&P 500 Variance stub positions. In making that determination, the Trade Desk may consider all relevant factors, including the last trade price for such Contract, a better bid or offer price, a more recent price in a different contract month and the prices of related contracts trading on the Exchange and other markets. In accordance with Policy and Procedure III: (i), the determination of whether a standard input error occurred is solely within the Trade Desk's discretion and (ii) the busting or adjustment of a trade by the Trade Desk due to a standard formula input error may only occur on the same calendar or Business Day that the trade occurred.
TERMINATION OF TRADING:	The close of trading on the day before the Final Settlement Date. When the last trading day is a CFE holiday, the last trading day for expiring S&P 500 Variance futures contracts will be the business day immediately preceding the last regularly-scheduled trading day.
FINAL SETTLEMENT DATE:	The third Friday of the expiring month. If the third Friday of the expiring month is a CFE holiday, the Final Settlement Date for the expiring contract shall be the CFE business day immediately preceding the third Friday.
FINAL SETTLEMENT VALUE:	The final settlement price will be determined according to the following formula and rounded to the nearest 0.0001: $$F_T = Realized\ Variance - k_0 - ARMVM + 1{,}000$$ The Realized Variance is based on a standardized calculation of the realized variance for the S&P 500. This calculation uses continuously compounded daily returns for a defined period assuming a mean daily price return of zero. The calculated variance is then annualized assuming 252 business days per year. The final realized variance value is this annualized, calculated variance multiplied by 10,000. The Variance Strike, k_0, will be set at 3:15 p.m. (Chicago time) on the business day immediately preceding the first trading day of each S&P 500 Variance futures contract listed. The Accumulated Return on Modified Variation Margin (ARMVM) is an adjustment to the final settlement price to account for the accumulation of interest on daily Variation Margin.
VARIANCE FORMULA:	For purposes of calculating the settlement value, the realized variance is calculated from a series of values of the S&P 500 beginning with the closing price of the S&P 500 on the first day a contract is listed for trading, and ending with the S&P 500 Special Opening Quotation (SOQ) on the final settlement date. $$\text{Realized Variance} = \left(252 \times \sum_{i=1}^{N_a - 1} \frac{R_i^2}{N_e - 1} \right) \times 10{,}000$$ Where, $R_i = ln(P_{i+1}/P_i) -$ Daily return of the S&P 500 from P_i to P_{i+1} $P_{i+1} -$ The final value of the S&P 500 used to calculate the daily return. $P_i -$ The initial value of the S&P 500 used to calculate the daily return. $N_e -$ Number of expected S&P 500 values needed to calculate daily returns from the date the contract is listed until settlement. The total number of daily returns expected from the date the contract is listed until settlement is N_e - 1.

	N_a – The actual number of S&P 500 values from the date the contract is listed until settlement used to calculate daily returns. Generally, the actual number of S&P 500 values will equal the expected number of S&P 500 values (represented by N_e). However, if one or more "market disruption events" occurs while the contract is listed, the actual number of S&P 500 values will be less than the expected number of S&P 500 values by an amount equal to the number of market disruption events that occurred. The total number of actual daily returns is $N_a - 1$.
VARIANCE STRIKE:	The Variance Strike ("fair variance") will be set at 3:15 p.m. (Chicago time) on the business day immediately preceding the first trading day of each S&P 500 Variance futures contract listed. For an S&P 500 Variance futures contract to be listed by the Exchange, the Exchange will identify a CBOE S&P 500 Index option with an expiration that precedes the expiration of the S&P 500 Variance futures contract and a CBOE S&P 500 Index option with an expiration that follows the expiration of the S&P 500 Variance futures contract. The formula below will be applied to the two identified S&P 500 Index options to calculate the Variance Strike for the S&P 500 Variance futures contract to be listed. The variance strike is determined by interpolating between the two resulting variance values (i.e., by averaging the values weighted by time to expiration). $$k_0 = \left(\frac{2}{T} \sum_i \frac{\Delta K_i}{K_i^2} e^{RT} Q(K_i) - \frac{1}{T} \left[\frac{F}{K_{ATM}} - 1 \right]^2 \right) \times 10,000$$ T = Time to expiration F = Forward index level derived from index option prices K_{ATM} = First strike below the forward index level, F K_i = Strike price of ith out-of-the-money option; a call if $K_i > K_0$ and a put if $K_i < K_0$; both put and call if $K_i = K_0$. K_i = Interval between strike prices – half the difference between the strike on either side of K_i: $$\Delta K_i = \frac{K_{i+1} - K_{i-1}}{2}$$ R = Risk-free interest rate to expiration $Q(K_i)$ = The midpoint of the bid-ask spread for each option with strike K_i. If the Exchange is unable to calculate the Variance Strike using the above formula at 3:15 p.m. (Chicago time), the Exchange may in its sole discretion establish a Variance Strike that it deems to be a fair and reasonable reflection of what the market was at that time.
ARMVM:	The Accumulated Return on Modified Variation Margin is an adjustment to the final settlement price to account for the accumulation of interest on daily Variation Margin. $$ARMVM = \sum_{t=0}^{T-1} (F_t - 1,000) \times \frac{R_t}{360} \times B_{t+1,T}$$ Where:

	F_t= The daily settlement value of the S&P 500 Variance futures contract. R_t= The daily Fed Funds rate applied to the daily Variation Margin $B_{t+1,T}$= An accumulation factor applied to the daily Variation Margin, which equals $\left(1 + \frac{R_{t+1}}{360}\right)\left(1 + \frac{R_{t+2}}{360}\right)...\left(1 + \frac{R_{T-1}}{360}\right)$
MARKET DISRUPTION EVENTS:	A "market disruption event" with respect to the S&P 500 Variance futures contract and as determined by CFE, means (i) the occurrence or existence, on any trading day during the one-half hour period that ends at the Scheduled Close of Trading, of any suspension of, or limitation imposed on, trading on one or more of the primary exchange(s) of the companies comprising the S&P 500 in one or more securities that comprise 20 percent or more of the level of the S&P 500; or (ii) if on any trading day the one or more primary exchange(s) determines to change the Scheduled Close of Trading by reducing the time for trading on such day, and either no public announcement of such reduction is made by such exchange or the public announcement of such change is made less than one hour prior to the Scheduled Close of Trading; or (iii) if on any trading day one or more primary exchange(s) fails to open and if in the case of either (i) or (ii) above, in the determination of CFE, such suspension, limitation, or reduction is deemed material. "Scheduled Close of Trading" means that time scheduled by each applicable exchange, as of the opening for trading in the applicable equity security, as the closing time for the trading of such equity security comprising the S&P 500 on the trading day. Generally, if CFE determines that a market disruption event has occurred on a trading day, then the value of the S&P 500 on that day will be omitted from the series of values used to calculate realized variance. For each such market disruption event, the value represented by N_a in the formula set out under the heading "Variance Formula" will be reduced by one. If a market disruption event occurs on the Final Settlement Date, the final settlement value for S&P 500 Variance futures will be determined in accordance with the Rules and By-Laws of The Options Clearing Corporation (OCC). These Rules and By-Laws list actions that may be taken if a final settlement value is unavailable or the normal settlement procedures cannot be utilized. Such actions include, but are not limited to, postponing the Final Settlement Date until the first succeeding trading day in which a market disruption event has not occurred. It is intended that the value of the S&P 500 on the final day in the period, which is used in the calculation of the realized variance for the CFE S&P 500 Variance futures contract, will equal the corresponding final settlement price for expiring series of S&P 500 options listed on CBOE. Once the calculation period for realized variance begins, the value represented by N_e will not change regardless of the number of market disruption events that occur during the period, even if the Final Settlement Date is postponed. If the Final Settlement Date of the expiring futures contract is postponed, the calculation period for the next realized variance will be shortened by the number of market disruption events that occurred at the beginning of the period. Likewise, the value represented by N_e, will be reduced by the number of market disruption events that occurred at the beginning of the period. The first daily return of the shortened period for the next realized variance will be calculated using the same procedure as described above (the initial value for the first daily return is the variance strike calculated as

	specified above on the first day of the period and the final value for the first daily return is the closing value of the S&P 500 on the following trading day). For example, if the Final Settlement Date for the previous realized variance is postponed to Tuesday, the initial value for the first daily return of the next realized variance would be fair variance calculated using the S&P 500 on Tuesday's close and the closing value of the S&P 500 on Wednesday.
	As soon as practical under the circumstances, CFE shall endeavor to notify Trading Privilege Holders of the existence of a market disruption event. Failure to provide such notice will have no effect on the determination by CFE that a market disruption event has occurred.
DELIVERY:	Settlement of S&P 500 Variance futures contracts will result in the delivery of a cash settlement amount on the business day immediately following the Final Settlement Date. The cash settlement amount on the Final Settlement Date shall be the final mark to market amount against the Final Settlement Value of the S&P 500 Variance futures contract multiplied by $1.00.
POSITION LIMITS:	S&P 500 Variance futures contracts are subject to position limits under Rule 412. A person may not own or control contracts exceeding 125,000 units of variance notional net long or net short in all contract months of an S&P 500 Variance futures contract combined The foregoing position limits shall not apply to positions that are subject to a position limit exemption meeting the requirements of Commission Regulations and CFE Rules.