CME SPAN 2 Margin Framework

April 2023

Overview

CME SPAN 2 Framework High Level Overview

Overview

SPAN® framework has been an industry standard for margining for decades; but in recent years, the demands on margin methodology have increased. The SPAN 2 framework will preserve current risk appetite and some forecasting capabilities of SPAN, while incorporating new modelling, self-adjusting, reporting, and margin replication capabilities.

Key Features:

- Enhanced consideration of risk factors including Seasonality, Options Term Structure, and Liquidity/Concentration costs
- Dynamically adjusts margins while ensuring robust coverage and anti-procyclical changes to portfolios' margins
- Allows for a unified margining framework across futures and options, OTC swaps as well as Portfolio Margining programs and easier to extend to risk model other financial instruments as well (e.g. Cash products) in the future
- New sets of reports with greater visibility into margin breakdowns; explicit reporting of portfolio level liquidity/concentration margins
- Supports product growth and complexity as the SPAN 2 framework uses an enhanced infrastructure capable of adopting to new hardware and software innovations
- Transparency - Extensive toolkits, educational materials and replication support (scenario files, key parameter information) provided by CME Clearing

CME SPAN 2 Framework Rollout and Initial Product Scope

SPAN 2 Framework will be rolled out for specific product groupings in a phased multi-year approach after extensive testing

- The NYMEX energy futures and options (excluding power) carrying the majority of existing open interest will be the first set to migrate to SPAN 2 Framework
- CME will work with clearing members and service providers to extensively test technology for computing SPAN 2 Margin
- Over the next few years, margins for diversified portfolios will flow from products in the SPAN 2 framework and in existing SPAN methodology; appropriate levels of offsets will continue to be provided across products in SPAN and SPAN 2 framework.
- CME's margin services will support both margin frameworks, streamlining initial adoption of the framework and updated releases.

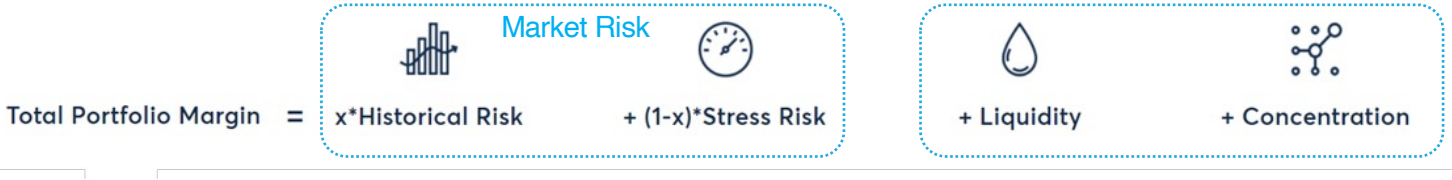
Total Day 1 Products In-Scope

CATEGORY	EXAMPLE PRODUCTS
Regular Futures - Seasonal & Non-Seasonal	CL, NG, NN, RB, HO
Vanilla Options on Regular Futures – Seasonal & Non-Seasonal	LO, LN, BZO, BE
Swaps and Spreads on Regular Futures	CS, BK, GZ, RBB
Non-Standard Options	AO, WA, BV, 9C

Please refer to CME Group's website for latest updates on product in-scope.

CME SPAN 2 Margin Model Framework

Framework Components and Methodology



Historical Risk

- Scenarios are based on historical movements
- Captures tail losses in a portfolio over the margin period of risk, MPOR (e.g. 1d, 2d) & with a desired confidence level (e.g. 99th percentile)
- Flexibility in defining a sufficient historical lookback period depending on the Product Group (e.g. 5 or 10yrs)
- Enhanced approach to model for seasonality, options risk, valuation uncertainty, etc.

Stress Risk

- Persists historical scenarios from stressed periods outside the historical component's lookback
- Allows for adding hypothetical scenarios inside a data-driven Historical Value-at-Risk (VaR) framework
- Several key benefits: Adding these stressed market scenarios enhances anti-procyclicality and other desirable coverage attributes (e.g. Margin Floors, Targeted Scenarios, etc.)

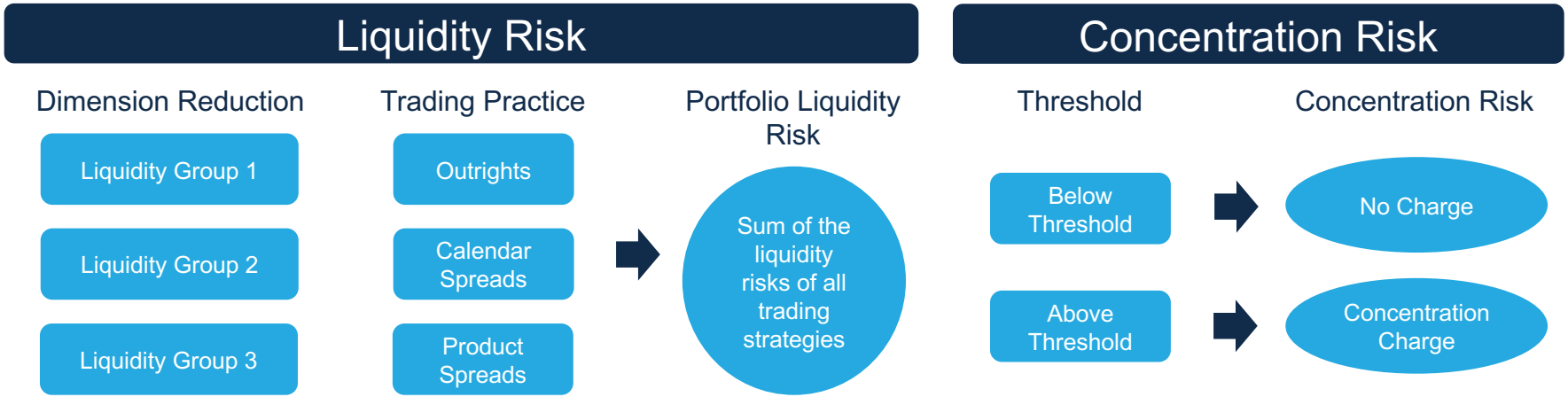
Liquidity and Concentration

- Captures the anticipated cost to hedge/liquidate the portfolio upon a default
- Sources liquidation cost information from market bid-offer quotes (e.g. from CLOB Order Books)
- Additional non-linear cost for large/concentrated positions in a portfolio
- Liq/Conc costs generated at individual portfolio level (each house & customer)

CME SPAN 2 Margin Model Framework

Liquidity and Concentration Risk

- Calibrated using available bid/ask/ADV data from CME's central limit order book (or alternative sources such as broker quotes, etc.). And costs determined for each client (CGM) and house account.
- Computation works on the principle of replicating the portfolio using a combination of available trading strategies,
  - Reflect the portfolio as a combination of traded strategies of different liquidity groups and then sums up their cost N
  - *Note: this design allows to effectively self-adjust and scale with changing trading patterns and liquidity profiles*
- In summary, combining trading practices and costs of actively traded strategies (outrights as well as higher order) to simulate the hedging/liquidation costs provides for precise, robust and stable cost estimations



Model Component Summary

Margining under SPAN 2 Methodology: Component Overview

Market Risk

For products still in SPAN Framework

$$Total\ Portfolio\ Margin = (x * Historical\ Risk + (1 - x) * Stress\ Risk + Liquidity + Concentration) + SPAN\ Methodology - Cross\ Model\ Offset$$

SPAN 2 Methodology

Market Risk

- Market Risk under SPAN 2 framework is calculated as a weighted sum of Historical Risk and Stress Risk.
  - **Historical Risk**
    - Historical Value at Risk (HVAR) Framework
  - **Stress Risk – Old Historical, Hypothetical as well as Event-Driven**
    - Stress VAR (sVAR) and Hypothetical sVAR Frameworks

Portfolio Liquidity Charge

- Captures close out costs during a default, based on available bid/ask spreads from central limit order book (or alternate sources if b/o unavailable on the screen)

Concentration Charge

- The concentration charge accounts for the additional cost of closing out large portfolios due to their size, an add on if the size of the holding is higher than specific threshold calibrated using daily volumes

SPAN Methodology

- SPAN methodology will still be used for products that are not in-scope for SPAN 2 methodology

Cross Model Offset

- Offsets will be available between SPAN and SPAN 2 margined products

CME SPAN 2 Margin Model Framework

Framework Components and Methodology

The different components in CME SPAN 2 Margin Model are as follows:

- **Historical Risk (HVaR Component) :** Assess the potential losses a portfolio can incur due to the daily price movements over a lookback period. HVaR uses historical data from an appropriate lookback and scenarios are generated using volatility and correlation scaling. Explicit treatment is made for seasonal risk and for options where the implied volatility surface issued included skew as risk factors. Like SPAN, the SPAN 2 framework will be based on a Value at Risk (HVaR) framework, using historical data to model how a position or portfolio may gain or lose value under various risk scenarios. This captures the tail losses in a portfolio over the Margin period of Risk (MPOR) (e.g., 1d, 2d) and with a desired confidence level. The lookback period will cover sufficient historical period (e.g., 5y or 10y).
  - HVaR calculation process:
    - The daily returns from the lookback period are calculated using values of each risk factor (e.g., Futures prices, volatilities, etc.) from two days that are MPOR (margin period of risk) days from each other
    - Additional return analysis are applied to these daily returns, e.g., correlation scaling, volatility scaling, etc..
    - The processed returns are applied to the current values (base values) of each corresponding risk factor to produce historical data drive scenarios
    - The price of all contracts are calculated using appropriate prices for each scenario
    - For each scenario, the P&L of the portfolio is calculated using aggregated scenarios prices of all contracts minus the corresponding aggregated base prices. For contracts that are not settled in USD, prices are converted to USD using FX rate
    - The portfolio's HVaR risk is measured as the tail value of the P&L distribution cross all scenarios.

CME SPAN 2 Margin Model Framework (Continued)

- **Stress Risk:** Assess the potential losses a portfolio can incur due to market events. This framework allows risk managers to add expert judgment to manage seen and unforeseen risk and is comprised of two parts:
  - **SVaR :** This is comprised of actual historical events within or outside the HVaR lookback window. This includes historical scenarios from long term and short term look back and scenarios selected for specific risk profiles.
    - The Portfolio P&L is calculated based on the using the historical scenario returns within a lookback period and additional scenarios

      from historical stress periods and calculate the Historical VAR like we did in HVAR above without the additional return analysis.
  - **Hypothetical SVaR** : This is comprised of scenarios that may not have occurred in history but can be assessed as future risk including structurally typical curve movements as parallel, slope, and curvature shifts, curve-shift with historical data inference and any specific scenario our risk managers define.
    - The basic concept of building hypothetical scenarios is to specify returns for all curves, the scenarios then applied to the base curve which in turns returns a portfolio scenario P&L. Based on these scenarios at a particular confidence interval the Hypothetical SVaR is calculated.

CME SPAN 2 Margin Model Framework (Continued)

- **Liquidity Component**: The liquidity charge captures close out costs during a default, based on available bid/ask spreads from central limited order book. Close out costs are assessed according to trading practices and costs observed in the market. The costs are calibrated to actual traded information for products when available.
  - The Bid Ask Spreads observed during the regular trading hours are selected to calculate the Liquidation Cost.
  - Along with the Bid Ask Spreads the Open Interest of the product during the observation window is also used to calibrate the Liquidation Parameters.

- **Concentration Component**: The concentration charge accounts for the additional cost of closing out large portfolios due to their size, an add on if the size of the holding is higher than specific threshold calibrated using daily volumes.
  - The Margin Model assumes that the portfolio can be liquidated within 1 Day MPOR. When the portfolio is concentrated only a part of it can be liquidated at regular trading hours while the remaining will be at extra cost.
  - The Threshold above which the Concentration charges will be applied to a portfolio depends on the Average Daily Volume(ADV), however ADV can be volatile at times hence a moving average of the ADV is used to calibrate the threshold.

- **SPAN Methodology** will still be used for products that are not in-scope for SPAN 2 methodology as the new margin model framework will be rolled out in a phased manner.
- **Cross Model Offset** : Offsets will be available between SPAN and SPAN 2 margined products which is implied by the covariance between the products.

Risk Reporting Framework

Concepts of POD and Product Group Level Reporting

For Day 1 implementation i.e., Energy asset class using new SPAN 2 margin methodology, we have two PODs – (1) Crude & Refined products and (2) Natural Gas products and for all SPAN products we will group it under one POD.

Product Group: Product groups level further breaks down the risk from one POD to different Product Groups. A POD can have one or more Product groups.

Below is a Test Portfolio with Crude Oil Future NYMEX, Crude Oil Options, BRENT LAST DAY CONTRACT, EMINI SP 500 ENERGY SECTOR INDEX and HENRY HUB NATURAL GAS Futures .

Futures & Options

Close

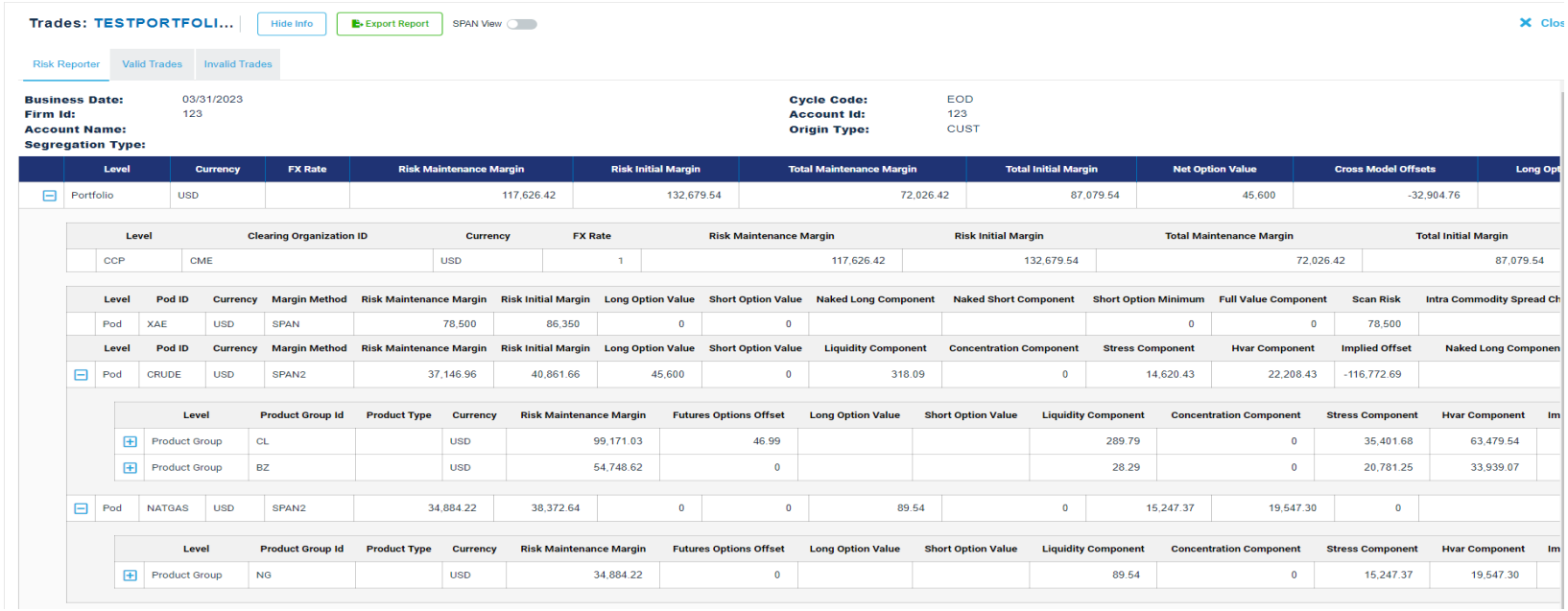
Trades: TESTPORTFOLIO | + New Trade | Edit | Delete | Positions View | Export | Show All

Firm	Account	Cleared	Clearing Code	Globex Ticker	Exchange	Product Name	Period Code	Clearing Org	Put/Call	Strike Price	Underlying Period Code	Net Positions	Cross Margin
123	123	No	XAE	XAEM3	CME	EMINI SP 500 ENERGY SECTOR INDEX	202306	CME				-10	No
123	123	No	NG	NGM3	NYMEX	NATURAL GAS HENRY HUB FUTURE	202306	CME				10	No
123	123	No	BZ	BZM3	NYMEX	BRENT LAST DAY CONTRACT	202306	CME				-10	No
123	123	No	CL	CLM3	NYMEX	CRUDE OIL FUTURE NYMEX	202306	CME				10	No
123	123	No	LO	LOM3 C7500	NYMEX	CRUDE OIL OPTIONS	202306	CME	CALL	75	202306	10	No

The snippets are from the CME CORE UI which is an interactive margin calculator that enables user to calculate initial margin requirements through manual entry or file uploads on all CME Group products.
A Link to which can be found here:
https://www.cmegroup.com/clearing/cme-core-overview-demo.html

CME SPAN 2 Margin Result Breakdown

Below is the Margin Result of the sample portfolio at Portfolio, POD and Product Group Levels.



Trades: TESTPORTFOLI... | Hide Info | Export Report | SPAN View | Clos

Risk Reporter | Valid Trades | Invalid Trades

Business Date: 03/31/2023
Firm Id: 123
Account Name:
Segregation Type:

Cycle Code: EOD
Account Id: 123
Origin Type: CUST

Level	Currency	FX Rate	Risk Maintenance Margin	Risk Initial Margin	Total Maintenance Margin	Total Initial Margin	Net Option Value	Cross Model Offsets	Long Opt
Portfolio	USD		117,626.42	132,679.54	72,026.42	87,079.54	45,600	-32,904.76	

Level	Clearing Organization ID	Currency	FX Rate	Risk Maintenance Margin	Risk Initial Margin	Total Maintenance Margin	Total Initial Margin
CCP	CME	USD	1	117,626.42	132,679.54	72,026.42	87,079.54

Level	Pod ID	Currency	Margin Method	Risk Maintenance Margin	Risk Initial Margin	Long Option Value	Short Option Value	Naked Long Component	Naked Short Component	Short Option Minimum	Full Value Component	Scan Risk	Intra Commodity Spread Ch
Pod	XAE	USD	SPAN	78,500	86,350	0	0			0	0	78,500	

Level	Pod ID	Currency	Margin Method	Risk Maintenance Margin	Risk Initial Margin	Long Option Value	Short Option Value	Liquidity Component	Concentration Component	Stress Component	Hvar Component	Implied Offset	Naked Long Componen
Pod	CRUDE	USD	SPAN2	37,146.96	40,861.66	45,600	0	318.09	0	14,620.43	22,208.43	-116,772.69	

Level	Product Group Id	Product Type	Currency	Risk Maintenance Margin	Futures Options Offset	Long Option Value	Short Option Value	Liquidity Component	Concentration Component	Stress Component	Hvar Component	Im
Product Group	CL		USD	99,171.03	46.99			289.79	0	35,401.68	63,479.54	
Product Group	BZ		USD	54,748.62	0			28.29	0	20,781.25	33,939.07	

Level	Pod ID	Currency	Margin Method	Risk Maintenance Margin	Risk Initial Margin	Long Option Value	Short Option Value	Liquidity Component	Concentration Component	Stress Component	Hvar Component	Implied Offset	Naked Long Componen
Pod	NATGAS	USD	SPAN2	34,884.22	38,372.64	0	0	89.54	0	15,247.37	19,547.30	0	

Level	Product Group Id	Product Type	Currency	Risk Maintenance Margin	Futures Options Offset	Long Option Value	Short Option Value	Liquidity Component	Concentration Component	Stress Component	Hvar Component	Im
Product Group	NG		USD	34,884.22	0			89.54	0	15,247.37	19,547.30	

The Margin Results will be organized at various levels (portfolio, pod, product group) and each level will contain further details for Margin Requirements, valuations, and sensitivities further broken down by currency when applicable. This structure will support results for Futures and Options products margined through SPAN and SPAN 2 risk models.

Currency, Margin, and Valuation requirements may reflect aggregation of the levels below. Sensitivities will not reflect aggregation and will generally be level specific. All requirements at the portfolio level will represent results that combine requirements across risk models. As the requirements are further decomposed to the Pod level, the results will become model specific. Each Pod has a margin method to describe the type of results..

CME SPAN 2 Margin Result Breakdown(Continued)

Level	Product Group Id	Product Type	Currency	Risk Maintenance Margin	Futures Options Offset	Long Option Value	Short Option Value	Liquidity Component	Concentration Component	Stress Component	Hvar Component
Product Group	CL		USD	99,171.03	46.99			289.79	0	35,401.68	63,479.54

Level	Product Group Id	Product Type	Currency	Risk Maintenance Margin	Futures Options Offset	Long Option Value	Short Option Value	Liquidity Component	Concentration Component	Stress Component	Hvar Component
Product Group	CL	OPT	USD	30,592.02				261.49	0	10,464.18	19,866.33
Product Group	CL	FUT	USD	68,532.02				28.29	0	24,937.5	43,566.22

At the product group level, results are detailed in margin component amounts which will be conditionally populated based on whether the product group result details are derived from the SPAN or SPAN 2 margin model. Margin results for each Product group is further decomposed into product types i.e Futures(FUT) and Options(OPT).

Margin Result Breakdown:

- All Margin Results will be represented in the PORTFOLIO currency i.e. USD in here.
- Margin Method describes the model which is used for margin calculations ,the accepted values in here are SPAN and SPAN2.
- The Risk Initial Margin (IM) will be reported at POD level and in this case the CUSTOMER ACCOUNT TYPE is SPECULATOR hence the IM is 1.1x of Risk Maintenance Margin. In cases where the Customer Account Type is Hedge or Member, the Risk Initial Requirement will equal the Risk Maintenance Margin.
- All Valuation Amounts like Long Option Value, Short Option Value, Naked Long Component, Naked Short Component, Full Value Component will be reported at POD Level.
- **SCAN Risk :** The requirement derived by Span which reflects the hypothetical single-day exposure given the Exchange or Clearing Organization's in this example EMINI SP 500 ENERGY SECTOR INDEX margin requirement is from SPAN.
- In this example the SPAN 2 margin result contains two PODS, CRUDE and NATGAS. The Market risk (HVAR + Stress Component) is calculated and represented at both POD level and at PRODUCT Group (PG) level however the **Implied Offset** which is $116K is determined by the difference between the margin calculated at POD level and at Product Group level.

Implied Offset = Market Risk(CRUDE POD)-Market Risk(CL PG)-Market Risk(BZ PG)

CME SPAN 2 Margin Result Breakdown(Continued)

- The "**Cross Model Offsets**" (as in this example applied between EMINI SP 500 ENERGY SECTOR INDEX (P2) and Crude Oil Future NYMEX (P1)) will be implied from the covariance of the products that will be margined using the SPAN 2 methodology and the ones which will remain on the SPAN methodology.

- VUM(P1) denotes the **Valuation Uncertainty Margin** for P1 ,it corresponds to the Pricing Error P&L for Option sub portfolio which is arising from the difference between implied volatility which is Interpolated or Extrapolated and the observed one.

$$M1(P1) = \alpha \times HVaR(P1) + (1-\alpha) \times SVaR(P1) + VUM(P1) + TLC(P1)$$

  TLC(P1) denotes the Total Liquidity and Concentration charge for P1

- **Short Option Minimum:** Deep OTM short options may show zero or minimal risk given the price and volatility moves in the market, however, in extreme events, these options may move closer to ATM or ITM, thereby generating potentially large losses. To account for this potential exposure, the Short Option Minimum(SOM) will be applied to handle the risk from shorting large amount of deep OTM options.

  For given short option contract, the SOM charge is calculated as:

$$\boldsymbol{SOMj = contract\ size \times unit\ SOM\ costj}$$

  - We then apply the Pod SOM floor on the raw pod margin as the following equation to arrive at the SPAN2 Pod Margin(M1(P1)):

$$\boldsymbol{M1(P1) = Max(\ Raw\ Pod\ Margin(P1), SOM(P1))}$$

- **The Long Option Value (LOV)** capping will be applied on portfolios containing equity style options only in long side. The intuition behind is that option premium has paid upfront for equity-style options. Option buyers does not lose more than this premium paid. At the worst scenario, the option buyer could take no action and let the option expire naturally, therefore does not subject to any risk, which in terms of margin, should not pay any margin over such a portfolio.

  Thus, the LOV capping applied on the pod portfolio maintenance margin is defined as below:

$$\boldsymbol{M1(P1)} = \begin{cases} \boldsymbol{min(M1(P1), LOV(P1))} \\ \boldsymbol{M1(P1)} \end{cases}$$

  Below are the two criteria which must be met for the LOV capping:

  - All contracts must be long options in pod P1.
  - All contracts must be equity-style option products for pod P1

Disclaimer

Neither futures trading nor swaps trading are suitable for all investors, and each involves the risk of loss. Swaps trading should only be undertaken by investors who are Eligible Contract Participants (ECPs) within the meaning of Section 1a(18) of the Commodity Exchange Act. Futures and swaps each are leveraged investments and, because only a percentage of a contract's value is required to trade, it is possible to lose more than the amount of money deposited for either a futures or swaps position. Therefore, traders should only use funds that they can afford to lose without affecting their lifestyles and only a portion of those funds should be devoted to any one trade because traders cannot expect to profit on every trade.

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