



BURSA MALAYSIA DERIVATIVES CLEARING BHD

MARGINING GUIDE

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This booklet explains the methodology adopted by Bursa Malaysia Derivatives Clearing Bhd (“BMDC”) to determine margins requirement. It is intended as a generic guide for the industry to understand the concept of margining and is solely for information purpose only. Therefore, this booklet does not provide a comprehensive explanation of all the process involved in margining or cover all the contract scenarios encountered by all participants.

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MARGINS

The Clearing House becomes the central counterparty to all open contracts traded by its clearing participants in order to ensure the timely and orderly performance of financial obligations under the contracts. The Clearing House employs a range of procedures in managing its exposure to the credit risk of its clearing participants. These procedures include the collection of performance bond, also known as margin on open positions and the revaluation of contracts on a daily basis.

Type of margins

Margins are intended to provide protection to the Clearing House from current exposures as well as from the potential futures increase in exposures. The Clearing House collects two types of margins:

- Settlement variation or variation margin
 - to cover losses arising from revaluation of open contracts at current prices, usually daily, so that the exposure is limited to a one-day price movement
- Performance bond / initial margin
 - to cover potential losses arising from liquidation of a defaulting participant's position

Performance bond / Initial margin

Performance bond or initial margin are calculated for both futures and option contracts on open positions to protect the Clearing House against potential exposure. This amount is intended to cover the expected largest one-day price movement which is calculated based on daily volatilities across a range of historical time interval. Its objective is to ensure market order and safety while reducing the costs for financing operations on the market. The Clearing House uses the Standard Portfolio Analysis of Risk® (SPAN®) methodology to determine the appropriate margin level for a portfolio of positions. The next section describes the methodology of the SPAN® performance bond calculation.

Treatment of spot / delivery month charge

The spot / delivery month charge is applicable on the FCPO and FPKO contract. This delivery add-on charge will be applied to open positions held in the spot month of FCPO and FPKO begin on the first business day after the last day of the previous delivery cycle.

STANDARD PORTFOLIO ANALYSIS OF RISK® (SPAN®)

Introduction

SPAN® is a portfolio risk-based margining system developed by the Chicago Mercantile Exchange in 1988. The SPAN® method calculates the performance bond requirement based on the estimation of the overall risk exposure of a portfolio, combining the futures and options positions. Several risk scenarios are used by SPAN® to gauge the liquidation value of a portfolio in adverse market conditions. In general, the following events are considered:

- possible underlying price movement
- possible underlying volatility movement
- impact of time decay on option value

Performance bond therefore represents the most unfavourable liquidation value and this data is stored in risk arrays, which are specific to each contract and updated on a daily basis.

SPAN® Methodology

Combined Commodities

The core of SPAN® risk analysis is to simulate potential market moves and calculate the profit or loss on individual contracts. SPAN® organizes all futures and options relating to the same underlying assets into one combined commodity for analysis. For example, the FTSE KLCI Futures (FKLI) and options on FKLI (OKLI) will be grouped under the same combined commodity. By placing contracts in the same combined commodity, credit margins of one contract can be fully used to offset margin liabilities in another contract. SPAN® generally first analyses the risk of each combined commodity in isolation from other combined commodities, then seeks risk reducing offsets between combined commodities.

Risk Array and Scanning Risk

The SPAN® risk array is a set of 16 scenarios defined for a particular contract specifying how a hypothetical single long position will loss or gain value if corresponding risk scenario occurs from the current situation day to the next day. By convention, losses for long positions are expressed as positive numbers, and gains as negative numbers. Each risk scenario is defined in the following terms:

- the (underlying) price movement: upward (+) and downward (-) with corresponding scan range fraction (0, 1/3, 2/3, 1, or 2)
- the (underlying) volatility movement: upward (+) and downward (-) with corresponding scan range fraction (0, 1/3, 2/3, 1, or 2)
- the weight, also called the covered fraction

For futures products, these are the price movement and volatility movement for the instrument itself. For options products, these are the price and volatility movements for the underlying instrument.

The values of the price movement, the volatility movement, and the weight are determined in the 16 scan point and by the two scan ranges, the price scan range and the volatility scan range. These two key values, also called margining parameters are determined by the Clearing House Risk Management team. The price scan range is also known as performance bond / initial margin rate.

Each risk array value is calculated as the current value of the contract less the hypothetical future value, taking into account the (underlying) price and volatility movement associated with the risk scenarios then multiplied by the weight. Typically, the change in value for futures product is determined by the price change alone. For option's hypothetical future value, the underlying price and volatility change; decrease in time to expiration and associated interest rates will be taken into account.

The 16 scan points adopted by BMDC:

Scan Point / Risk Scenario	Underlying Price Change as % of Price Scan Range	Volatility Change	Weight / Covered Fraction
1	0	1	100%
2	0	-1	100%
3	1/3	1	100%
4	1/3	-1	100%
5	-1/3	1	100%
6	-1/3	-1	100%
7	2/3	1	100%
8	2/3	-1	100%
9	-2/3	1	100%
10	-2/3	-1	100%
11	1	1	100%
12	1	-1	100%
13	-1	1	100%
14	-1	-1	100%
15	2	0	35%
16	-2	0	35%

Scenario 15 and 16 assume extreme movement on the price change but only a fraction of the loss is covered. The purpose of the extreme move is to cover the losses for deep out-of-the-money options. As mentioned earlier, the change in volatility does not affect futures although all positions are examined over these same scenarios. A portfolio consisting only futures positions would typically have its maximum losses under scenario 11 or scenario 13, depending on whether the portfolio is long or short. The risk array values are in currency in which the specific contract is denominated. For each contract, a risk array with 16 loss and gain value is generated on a daily basis, for a single long position. Following table is an example of the risk array using the FKB3 contract with price scan range of RM1,000:

Scan Point / Risk Scenario	Risk Array Value
1	0
2	0
3	-333
4	-333
5	333
6	333
7	-667
8	-667
9	667
10	667
11	-1,000
12	-1,000
13	1,000
14	1,000
15	-700
16	700

Risk arrays represent the hypothetical gain or loss for one contract examined over the 16 risk scenarios. To evaluate the portfolio risk, SPAN[®] calculates first of all the scanning risk at combined commodity level in accordance to the following steps:

1. Multiply each contract positions quantity by each of the 16 risk arrays value of the corresponding contract. For long positions, multiply by a positive position size and vice versa.
2. Sum across the arrays to find the loss by scenario for the combined commodity. Ignore any differences between contract months, expirations or strike prices. This yields 16 scenarios amount for that combined commodity.
3. The largest positive number represents the largest total loss for the combined commodity. This amount is known as scanning risk.

The scenario that yields the largest loss (largest positive number) for the combined commodity is called the active scenario. If two scenarios have the same amount, the one with lower scenario number will be the active scenario. Using earlier example, scenario 13 and 14 give the same amount of RM1,000, scenario 13 will be defined as the active scenario. The next table demonstrates the scanning risk calculation for a portfolio using FKLI as example:

- Long 1 January 2012 FKLI contract
- Short 2 February 2012 FKLI contract
- Price scan range is RM5,000

Scan Point / Risk Scenario	FKLI Jan2012 (+1)	FKLI Feb2012 (-2)	Portfolio Gain / Loss
1	0	0	0
2	0	0	0
3	-1,667	3,334	1,667
4	-1,667	3,334	1,667
5	1,667	-3,334	-1,667
6	1,667	-3,334	-1,667
7	-3,334	6,668	3,334
8	-3,334	6,668	3,334
9	3,334	-6,668	-3,334
10	3,334	-6,668	-3,334
11	-5,000	10,000	5,000
12	-5,000	10,000	5,000
13	5,000	-10,000	-5,000
14	5,000	-10,000	-5,000
15	-3,500	7,000	3,500
16	3,500	-7,000	-3,500

Scanning risk amount for this portfolio will be RM5,000 and the active scenario is 11.

Intracommodity Spread Charge

In scanning across commodities, SPAN® treats all contract months the same by assuming that futures prices are perfectly correlated and move in exactly the same way. In another word, SPAN® scanning risk assumes that one long delta in a given month exactly offsets one short delta in another month. However, in reality the futures (underlying) price may not be perfectly correlated across the combined commodity. Value gains in one month may not exactly offset value losses in another contract month, thus giving rise to an intermonth basis risk within a commodity.

SPAN® calculates the net delta for each combined commodity and each contract in the portfolio. By definition, delta for futures contracts is always 1. To calculate the intracommodity spread, SPAN® first calculates long net delta and short net delta on the other hand according to the tiers defined. A tier defines how the net delta will be gathered by different maturity month. SPAN® then forms intracommodity spread between the long and short net delta by priority defined. Intracommodity charge rate will then be applied to each spreads formed. Currently all contracts are being grouped into two tiers (except for physical delivery contract such as FCPO and FPKO) and two intracommodity spreads are formed. Using FKLI as example:

Tier	Contract Month
1	1 (Spot)
2	2 - 4

Priority	Spread Pair	Intracommodity Charge
1	Tier 1 : Tier 2 (Spot month spread)	RM 350
2	Tier 2 : Tier 2 (Back month spread)	RM 300

For portfolio involving option positions, SPAN® calculates the composite delta to determine the spreadable position according to the 7 delta points:

Delta Point	Underlying Price Change as % of Price Scan Range	Volatility Change	Weight / Covered Fraction
1	-1	0	3.7%
2	-2/3	0	11.1%
3	-1/3	0	21.7%
4	0	0	27%
5	1/3	0	21.7%
6	2/3	0	11.1%
7	1	0	3.7%

Spot / Delivery Month Charge

SPAN® allows for a delivery add-on charge to be established recognizing the additional risk of portfolios with positions in the delivery month. This delivery add-on charge is only applied to open positions held in the spot month of physical delivery products. All open positions held in the spot month are also isolated in a separate tier, meaning that no spreading is allowed for spot month positions. Consider the following FCPO spot month contract example:

Scan Point / Risk Scenario	Gain / Loss
1	0
2	0
3	-2,000
4	-2,000
5	2,000
6	2,000
7	-4,000
8	-4,000
9	4,000
10	4,000
11	-6,000
12	-6,000
13	6,000
14	6,000
15	-4,200
16	4,200

Scanning risk amount is RM6,000 and the spot month charge is RM250. Thus the SPAN requirement for this portfolio is RM6,250.

Intercommodity Spread Credit

SPAN® recognizes that for contracts with similar underlying instruments, the price movements of those could be highly correlated. As spreads position reduces risk, SPAN® gives a credit to the portfolio margin requirement. Spreads are formed using the net deltas of the commodities and saving is expressed in percentage. Generally the spread credit is determined in priority order as defined by Clearing House and is typically be ordered so that spreads with higher credit are being considered first. Consider the following portfolio consist of futures positions only:

- Long 2 June 2014 FCPO contract
- Short 4 September 2014 FPOL contract
- Long 1 June 2014 FUPO contract
- Price scan range is RM4,000 (FCPO); USD1,500 (FPOL) and USD1,500 (FUPO) respectively
- Intercommodity spread priority table:

Priority	Intercommodity Spread	Delta Ratio	Spread Credit
1	CPO : UPO	1 : 1	70%
2	CPO : POL	1 : 1	40%
3	POL : UPO	1 : 1	25%

Combined Commodity	Open Position	Outright PB Requirement	Spread Credit	SPAN Requirement
CPO	+2	RM 8,000	<u>(CPO : POL)</u> RM 4,000 x 2 x 40% = RM 3,200	RM 4,800
POL	-4	USD 6,000	<u>Step 1 (CPO : POL)</u> USD 1,500 x 2 x 40% = USD 1,200 (Remaining net delta of -2) <u>Step 2 (POL : UPO)</u> USD 1,500 x 1 x 25% = USD 375	USD 4,425
POL	+1	USD 1,500	<u>(POL : UPO)</u> USD 1,500 x 1 x 25% = USD 375	USD 1,125

Computation of Intercommodity Spread Credit for portfolio with futures positions only is rather straightforward as demonstrated in the previous example. For portfolio involving option contract, the Weighted Futures Price Risk is used to calculate the spread credit. The evaluation of Scanning Risk using the 16 scenarios as explained earlier is essentially an approximation of the following:

$$\text{Scanning Risk} = \text{Futures Price Risk} + \text{Volatility Risk} + \text{Time Risk}$$

Since the Intercommodity Spreads are based on deltas and reactions to futures price changes, these spreads will adjust only the Futures Price Risk. Delta values and the resulting spreads do not directly relate either to Volatility Risk or to Time Risk. Thus, the Futures Price Risk must first be isolated from the Scanning Risk and then divided by the corresponding net delta resulting in the Weighted Futures Price Risk.

In order to identify the Futures Price Risk, firstly isolate the Time Risk by taking the average of the Scanning Risk of Scenario 1 and 2. This is because Scenario 1 and 2 do not consider any underlying price movement, they only taking into consideration the up and down movement of volatility. By taking average of the two Scanning Risk, the Volatility Risk is eliminated and estimation of Time Risk is obtained.

The approximation above can also be seen as follow:

$$\text{Futures Price Risk} = (\text{Scanning Risk} - \text{Volatility Risk}) - \text{Time Risk} = \text{Volatility Adjusted Risk} - \text{Time Risk}$$

The Volatility Adjust Risk can be obtained by taking the average between Scanning Risk value of Active Scenario and its paired scenario. Active Scenario and paired scenario have the same underlying price variation, but opposite volatility variations. The following table lists out all the pairs:

Active Scenario	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Paired Scenario	2	1	4	3	6	5	8	7	10	9	12	11	14	13	15	16

Note: Scenario 15 and 16 are paired with themselves as they do not consider any volatility movement

Then, the Weighted Futures Price Risk is obtained by dividing the Futures Price Risk of the portfolio for a given Combined Commodity (SPAN[®] sets it to zero if the result is negative) by the absolute value of its total Net Delta. Spreads are then formed using the net deltas of the commodities as shown earlier. Example of Intercommodity Spread Credit calculation involving option positions is shown at the end of this document.

Short Option Minimum

Deep-out-of money options may show zero or minimal scanning risk given the price and volatility movements in the 16 risk scenarios. However, these short option positions may move closer to in-the-money in extreme market where there is sharp change in the underlying price. Thus, SPAN[®] assigns a short option minimum to each of the combined commodity with option products to account for this potential exposure.

All short options, including calls and puts are summed up and multiplied by the respective short option charge to yield the short option minimum. This short option minimum is not an additional requirement

to the portfolio SPAN[®] risk, but represents the minimum margin requirement for the portfolio. SPAN[®] takes the larger of SPAN[®] requirement calculated and short option minimum as the portfolio margin.

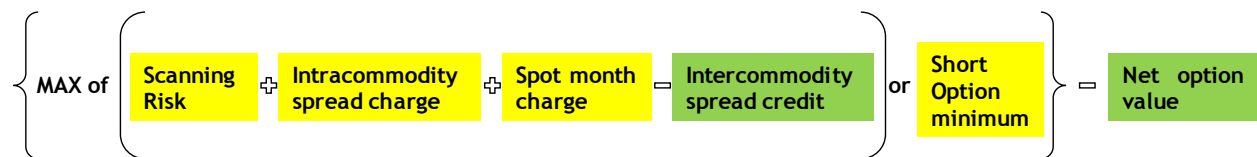
Net Option Value

The SPAN[®] recognizes the equity value of option contacts and gives credit for the amount of option liquidation value in the portfolio. This equity can reduce or increase the portfolio SPAN[®] requirement depending on whether the portfolio has positive or negative equity. SPAN[®] marks-to-market the options position to determine the option value. Long option is multiplied by its market value to obtain the long option value (LOV) and short option is multiplied by its market value to obtain the short option value (SOV). LOV minus SOV yields the net option value (NOV). Positive NOV reduces the portfolio margin amount and vice versa. In the case where NOV is greater than the combined commodity SPAN[®] requirement, the difference is called excess net option value (ENOV) and can be used to reduce the SPAN[®] requirement of other combined commodity provided they share the same denominated currency.

Performance Bond Amount

The performance bond amount required for a given combined commodity is the result of the calculations in the steps described above:

1. Sum the *scanning risk*, the *intra-commodity spread charge*, and the *spot month charge*
2. Subtract the *inter-commodity spread credit*
3. Take the larger of this result, and the *short option minimum*. This yields the SPAN[®] Risk Requirement
4. Subtract net option value to obtain the performance bond amount for this combined commodity. ENOV will be used to reduce the requirement for other combined commodity.



The summation of all combined commodities performance bond amount then equals to the portfolio performance bond amount.

Sample Portfolio

Consider the following portfolio consist of futures and options positions:

- Point in time: 14 February 2014 End-of-Day
- Interest rate: 2.97%
- Implied volatility: 18.16%
- Option pricing model: Black-76 Model

Combined Commodity	Price Scan Range	Volatility Scan Range	Spot Month Charge	Spot Month Spread	Back Month Spread
CPO	RM 4,000	5%	RM 250	-	RM 600
POL	USD 1,500	-	-	-	USD 200
UPO	USD 1,500	-	-	USD 550	USD 500

Priority	Intercommodity Spread	Delta Ratio	Spread Credit
1	CPO : UPO	1 : 1	70%
2	CPO : POL	1 : 1	40%
3	POL : UPO	1 : 1	25%

Contract	Open Position	Settlement Price	Underlying Price
FCPO Feb2014 (spot month)	Long 1	-	-
OCPO Jun2014 @ 2,700 Call	Short 5	40	2,616
OCPO Jul2014 @ 2,650 Call	Long 1	71.5	2,608
FPOL Mar2014	Long 5	-	-
FPOL Apr2014	Short 1	-	-
FUPO Jun2014	Short 1		

Scanning Risk:

- For FCPO Feb2014 (spot month in isolated scan tier):

Scan Point / Risk Scenario	FCPO Feb2014 (+1)
1	0
2	0
3	-1,333
4	-1,333
5	1,333
6	1,333
7	-2,667
8	-2,667
9	2,667
10	2,667
11	-4,000
12	-4,000
13	4,000
14	4,000
15	-2,800
16	2,800

Scanning Risk is RM 4,000 and the Active Scenario is 13.

- For other positions in CPO Combined Commodity:

Scan Point / Risk Scenario	OCPO Jun2014 @ 2,700 C (-5)	OCPO Jul2014 @ 2,650 C (+1)	Total
1	2,215	-591	1,624
2	-2,305	624	-1,681
3	5,015	-1,254	3,761
4	-10	-6	-16
5	-5	-25	-30
6	-3,710	1,086	-2,624
7	8,410	-2,013	6,397
8	3,295	-803	2,492
9	-1,695	445	-1,250
10	-4,460	1,399	-3,061
11	12,375	-2,863	9,512
12	7,600	-1,751	5,849
13	-2,915	823	-2,092
14	-4,805	1,591	-3,214
15	9,005	-1,920	7,085
16	-1,720	591	-1,129

Scanning Risk is RM 9,512 and the Active Scenario is 11.

➤ For POL Combined Commodity:

Scan Point / Risk Scenario	FPOL Mar2014 (+5)	FPOL Apr2014 (-1)	Total
1	0	0	0
2	0	0	0
3	-2,500	500	-2,000
4	-2,500	500	-2,000
5	2,500	-500	2,000
6	2,500	-500	2,000
7	-5,000	1,000	-4,000
8	-5,000	1,000	-4,000
9	5,000	-1,000	4,000
10	5,000	-1,000	4,000
11	-7,500	1,500	-6,000
12	-7,500	1,500	-6,000
13	7,500	-1,500	6,000
14	7,500	-1,500	6,000
15	-5,250	1,050	-4,200
16	5,250	-1,050	4,200

Scanning Risk is USD 6,000 and the Active Scenario is 13.

➤ For UPO Combined Commodity:

Scan Point / Risk Scenario	FUPO Jul2012 (-1)
1	0
2	0
3	500
4	500
5	-500
6	-500
7	1,000
8	1,000
9	-1,000
10	-1,000
11	1,500
12	1,500
13	-1,500
14	-1,500
15	1,050
16	-1,050

Scanning Risk is USD 1,500 and the Active Scenario is 11.

Thus,

Scanning Risk for CPO Combined Commodity = RM 4,000 + RM 9,512 = RM 13,512

Scanning Risk for POL Combined Commodity = USD 6,000

Scanning Risk for UPO Combined Commodity = USD 1,500

Spot Month Charge:

Spot Month Charge for CPO Combined Commodity = $1 \times \text{RM}250 = \underline{\text{RM}250}$

Intracommodity Spread Charge:

- Composite Delta computed by SPAN for *Five Short OCPO Jun2014 @ 2,700 C* = - 1.7295
Composite Delta computed by SPAN for *One Long OCPO Jul2014 @ 2,650 C* = + 0.4419
- Delta for *Five Long FPOL Mar2014* = +5
Delta for *One Short FPOL Apr2014* = -1

Thus,

Intracommodity Spread Charge for CPO Combined Commodity = $0.4419 \times \text{RM}600 = \underline{\text{RM } 265}$

Intracommodity Spread Charge for POL Combined Commodity = $1 \times \text{USD}200 = \underline{\text{USD } 200}$

Intercommodity Spread Credit:

- For CPO, remaining delta is -1.2876. SPAN calculates the Weighted Price Risk = 5,987.11
- For POL, remaining delta is +4
- UPO delta is -1

Thus,

Intercommodity Spread Credit for CPO = $1.2876 \times 5,987.11 \times 40\% = \underline{\text{RM } 3,084}$

Intercommodity Spread Credit for POL = $[1.2876 \times 1,500 \times 40\%] + [1 \times 1,500 \times 25\%] = \underline{\text{USD } 1,148}$

Intercommodity Spread Credit for UPO = $1,500 \times 25\% = \underline{\text{USD } 375}$

Net Option Value:

- Short Option Value (OCPO) = $40 \times 25 \times (-5) = -\text{RM } 5,000$
- Long Option Value (OCPO) = $71.5 \times 25 \times 1 = \text{RM } 1,787.50$

Thus,

Net Option Value for CPO Combined Commodity = $\text{RM}1,787.50 - \text{RM}5,000 = \underline{-\text{RM } 3,212.50}$

PERFORMANCE BOND REQUIREMENT:

For CPO Combined Commodity, Performance Bond requirement

= Scanning Risk + Spot Month Charge + Intracommodity Spread Charge – Intercommodity Spread Credit –
Net Option Value

= 13,512 + 250 + 265 - 3,084 – (-3,212.50)

= RM 14,155.50

For POL Combined Commodity, Performance Bond requirement

= Scanning Risk + Intracommodity Spread Charge – Intercommodity Spread Credit

= 6,000 + 200 – 1,148

= USD 5,052

For UPO Combined Commodity, Performance Bond requirement

= Scanning Risk – Intercommodity Spread Credit

= 1,500 – 375

= USD 1,125

