SPAN® METHODOLOGY DERIVATIVES MARKET

1 INTRODUCTION

This document presents an overview of the method used to calculate margin requirements for the derivatives market based on SPAN® methodology.

A portfolio is defined as a set of positions entered on the clearing account of a given clearing member. The calculation of margins using SPAN® methodology for derivatives is performed by determining the increase or the fall in the value of the portfolio taking place under a pre-defined market scenario involving a price change and price volatility of the underlying instrument. A scenario involving the largest fall in the value of the portfolio is the basis used for calculating the required margin.

Risk scenarios recognise the influence of:

- Price changes of the underlying instrument

- Price volatility of the underlying instrument

- Changes to the option price as a result of a change in the time left to expiry

The final margin requirement is determined on the basis of the following partial calculations:

- scenario risk margin

- intra-class spread margin

- delivery margin

- inter-class spread credit

- minimum margin for short positions in options

2 DETAILED DESCRIPTION OF SPAN® ELEMENTS

2.1 Scenario risk margin (scanning risk margin)

The margin for scenario risk, calculated on the basis of analysis of the changes affecting the value of the portfolio within a given class under separate risk scenarios, is equal to the value of the risk in the worst-case market scenario (in SPAN® convention, this is the scenario with the highest added risk value).

2.2 Intra-class spread margin (inter-month spread charge)

The process used to determine the value of margins for risk scenarios, it is assumed that maturity prices within a given instrument class are perfectly correlated. In reality, this is not the case. It is therefore essential to calculate a special margin which enables a different correlation for maturity prices to be formed.

2.3 Delivery margin (delivery charge/spot charge)

The delivery margin is used to secure against the additional risk involving the settlement of transactions with the physical delivery of the underlying instrument.

This margin may also be used for spread positions cleared in cash with varying expiry dates, for which one leg is close to the expiry date. In such cases, this margin ensures additional protection in cases of unsecured positions in the remaining spread legs.

SPAN® methodology distinguishes two different delivery margins:
- Margin calculated for positions within the spread with other positions
- Margins calculated on unsecured positions

When calculating the delivery margin, positions for which the underlying instrument has been blocked on the delivery account of the clearing agent are not recognised.

2.4 Inter-class spread credit (inter commodity spread credit)

Since relatively strong correlations may exist between classes of instruments, credit may be assigned for certain pairs of positions in various classes.

Holding opposite positions in these classes may lead to a reduction in risk across the whole portfolio.

2.5 Minimum margin for short positions in options (short option minimum)

Portfolios holding short positions in options contain some residual risk. This margin ensures that the required margin securing the portfolio cannot be set at a lower rate than the level of the KDPW_CCP determined limit.

The value of the minimum margin for short positions in options ($mdko$) is calculated as follows:

Formula 1-1

$$mdko_{pk} = ko_{pk} \times dm_k$$

ko - number of short options positions

dm - minimum margin for a single short options position

p - portfolio index

k - class index

2.6 Margin calculation

The margin securing against the risk of a change in value of instruments in a portfolio in a given class DZW_{pk} in a assumed time horizon is calculated as the total of the scenario risk margin, the intra-class spread margin and the delivery margin less the inter-class spread. The value of the margin calculated in this way cannot however be smaller than the value of the minimum deposit for short options positions in this portfolio.

Formula 1-2

$$DZW_{pk} = max\{drsc_{pk} + dswk_{pk} + dd_{pk} - cspk_p; mdko_{pk}\}$$

$drsc$ - scenario risk margin

$dswk$ - margin for intra-class spread

dd - delivery margin

$cspk$ - inter-class spread credit

$mdko$ - minimum deposit for short options positions

p - portfolio index

k - class index

This margin only secures against the risk of price change; in order to calculate the initial margin for the portfolio within a given class, the value of the net options positions needs to be subtracted from the margin calculated.

Formula 1-3

$$DZK_{pk} = max(DZW_{pk} - PNO_{pk}; 0)$$

DZK_{pk} - margin securing against risk in portfolio p and class k of a given clearing member

PNO_{pk} - value of net options positions (number of positions multiplied by the options price)

In those instances where the value $(DZW_{pk} - PNO_{pk}; 0)$ is positive, it forms a margin requirement for a given class within the portfolio. In situations where the value $(DZW_{pk} - PNO_{pk})$ is negative, this value is separated as NOD_{pk} and will be used to lower the margin requirement in other classes within a given portfolio.

Formula 1-4

$$NOD_{pk} = -min(DZW_{pk} - PNO_{pk}; 0)$$

NOD_{pk} - excess value of long options positions in portfolio p and class k

The value of the required margin DZP for portfolio p of a given clearing member is a maximum value of the difference between the sum of the margins in each class and the sum of the excess of the long positions calculated for all classes and zero.

Formula 1-5

$$DZP_p = max\left\{\sum_k DZK_{pk} - \sum_k NOD_{pk}; 0\right\}$$

This allows the offset of margins within a single class through a positive value of net options positions in another class.

The value of the required margin DZU for a given clearing member is the sum total of the values of the required margins for each of the clearing member's portfolios.

Formula 1-6

$$DZU = \sum_p DZP_p$$

3 DETAILED RULES FOR CALCULATING MARGINS

3.1 Risk parameters

Calculating margin requirements using SPAN® methodology takes place using risk parameters calculated each day by KDPW_CCP on the basis of updated risk analysis. KDPW_CCP publishes on a daily basis a file containing in particular the values of the risk scenarios for each long position in each instrument, as well as:

- the delta value for each instrument
- the price variation
- the volatility variation
- option reference volatility
- risk free interest rate
- dividend rate
- level of minimum deposit for short options positions
- level definitions
- intra-class spread definitions
- inter-class spread definitions
- delivery margin

3.2 Scenario risk margin

SPAN® analyses changes in the portfolio value according to 16 scenarios of price and volatility variation.

Table 2-1 Risk scenario definitions

Scenario no.	Underlying price variation	Volatility variation	Profit/loss fraction taken into account (weighted)
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	+3	0	32%
16	-3	0	32%

The value of the risk under a given scenario is calculated as the difference between the theoretical and the market price of the instrument multiplied by the relevant weight.

The theoretical value of an instrument is calculated by determining a pre-defined timescale and price variation of the underlying instrument and its volatility under a given risk scenario. In order to calculate the theoretical value of the option, the relevant pricing model is used.

In certain instances, KDPW_CCP may use the theoretical price of the option instead of the market price to calculate the actual value of the option, assuming the same pricing model, the actual time to expiry, the actual value of the underlying instrument and the correct interest rate.

In order to calculate risk scenarios for futures, only the impact of the price variation is factored in; however, for options, both price variation and volatility variation, as well as the time scale are included in the calculation.

All parameters of the model are updated and made available by KDPW_CCP.

3.3 Calculating the active scenario

The scenario risk margin is equal to the greatest positive risk value calculated from among all 16 scenarios. A scenario calculated in this manner is called the active scenario.
Where there are several instruments that form part of the portfolio, the portfolio risk under a given scenario is calculated as the total of the risks for each instrument within a given scenario.
In instances where more than one scenario gives the same positive risk value in its result, then the scenario risk margin is deemed to be the portfolio value under the scenario with the lowest number.
Where there is no scenario with a positive value among the 16 risk scenarios, then the margin for scenario risk is assumed to hold a value of zero.

Note: scenarios contain only risk values; only at a later stage is the risk value adjusted with the net value of the options that are in the portfolio.

3.4 The concept of delta

In order to harmonise the approach to margin calculation for futures and options, delta calculations need to be made. The delta is the level of price sensitivity of a derivative instrument to price changes of the underlying instrument.

The delta is calculated to determine the following:
- the intra-class spread margin
- the delivery margin
- the inter-class spread margin

The delta for each long position is defined as follows:
- for call options – from 0 to 1
- for put options – from -1 to 0
- for futures – 1

3.5 Net delta calculation

The value of the delta for each position is calculated by multiplying the number of positions by a reference delta value determined by KDPW_CCP for a given instrument and the delta scaling factor. The purpose of the scaling factor is to level out the differences between the nominal values of the contracts.

Each position expressed in the delta is aggregated to a predefined future month.

For futures, the delta is aggregated to the expiry date of the contract, while for options, the delta is aggregated either to option expiry date, or the expiry date of the underlying instrument.

A net delta value is calculated for each separate future month as the sum total of deltas of all positions for a given month.

The concept of delta is related to the concept of level. The level is a range of several expiry months, for example: 2006-01, 2006-02, 2006-03. For each level, a positive and a negative delta value is calculated (the sum total of positive deltas and the sum total of negative deltas). The purpose of creating levels is to determine groups of future expiry months which are similar in terms of risk, which will enable a lower number of spreads to be defined and processed.

3.6 Margin for intra-class spread

The intra-class spread is commonly reflected by two opposite positions (expressed in the delta) held in derivatives within a given class (spreads containing more than two legs are also possible). For a spread to be generated, positions need to belong to levels specified within the spread definition prepared by KDPW_CCP.

When calculating the scenario risk margin, the principle that final prices are perfectly correlated is applied. SPAN® recognises this principle and assumes that the risk inherent in a long position in a given month is fully offset by the risk inherent in a short position in another future month.

The reality, however, is different. Losses on a position expiring in one month in the future do not have to be precisely offset by profits from a position expiring in another month. This additional risk is secured by the margin for intra-class spread.

The definition of the spread determined by KDPW_CCP contains a definition of each leg of the spread, their market side (long or short position), the level of the margin for the spread, the delta number for a given leg of the spread and the spread priority.

The first spread generated is assigned priority 1, then 2, 3 etc. The spread margin is calculated for the value of the positions creating the spread expressed in the delta.

For example: if leg 1 of the spread contains five negative delta values, leg 2 of the spread contains seven positive delta values, while the spread definition specifies that one delta from each level is needed to create it, then the following spread may be created: min(|-5|;|7|)=5.

The value of the spread used to create the previous spread is deducted from the available delta values for each subsequent spread.

3.7 Delivery margin

The delivery margin is used to secure against the additional risk for derivatives where settlement takes place through the physical delivery of the underlying instrument.

SPAN® methodology enables the differences between the risks to be recognised in instances where:
- unsecured positions settled by delivery are being held
- positions settled by delivery are being held that are in the spread with other positions
KDPW_CCP begins calculating the higher margin starting from the first day of the week in which the contract expires.

The margin for delivery is calculated for the value of the delta of positions settled through delivery.

3.8 Inter-class spread credit

The inter-class spread credit enables risk to be reduced where opposite positions are held in separate classes, however with similar risk features of the underlying instrument. KDPW_CCP determines the definition of the spread containing a description of the separate legs of the spread, their market side, the delta number for a given leg of the spread, the credit rate and the spread priority.

The SPAN® algorithm enables the credit to be calculated based on the price variation risk of the instrument. The price variation risk is calculated on the basis of the following factors:

Formula 2-1

Scenario risk = price variation risk + volatility risk+ time risk

The value of price variation risk is calculated by reformulating the equation, i.e., subtracting volatility risk and time risk from the given scenario risk.

The value of volatility risk is eliminated by finding a scenario paired with the active scenario number for a given class. Scenarios are paired so that each assumes an identical price change direction, however the opposite volatility change direction.

Scenarios 15 and 16 are paired with themselves since neither assumes a change of volatility.

Table 2-2 Scenario pairs

Risk scenario no.	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

E.g., if Scenario 13 is the active scenario, then the paired scenario is Scenario 14.

The value of scenario risk adjusted for volatility risk is obtained as follows:

Formula 2-2

Scenario risk adjusted for volatility risk = (active scenario risk + paired scenario risk)/2

Time risk is also calculated on the basis of risk scenarios. It should be noted that Scenarios 1 and 2 do not envisage price changes to the underlying instrument, only changes in volatility. By taking the mean risk value from Scenarios 1 and 2, volatility risk is eliminated (these are paired scenarios) and only pure time risk is left. Time risk can then be calculated using the following formula:

Formula 2-3

Time risk = (Scenario 1 risk + Scenario 2 risk)/2

The final price variation risk can be calculated according to the following formula:

Formula 2-4

Price variation risk = scenario risk adjusted for volatility risk – time risk

In order to calculate the value of the credit, the unit price variation risk will also need to be calculated. This is determined by dividing the value of price variation risk by the total value of the net delta within a given class.

Formula 2-5

Unit price variation risk = price variation risk / total net delta

The value of the credit is assigned in relation to the value of the delta within the interclass spread. In order for the interclass spread to be created, the delta in the spread must have the market side defined for the spread by KDPW_CCP.

The final value of the credit for a given class is calculated on the basis of the following formula:

Formula 2-6

Value of the credit = unit price variation risk x delta within the spread x number of deltas per spread x credit rate

The credit is calculated in relation to each leg forming the spread.

4 PRACTICAL EXAMPLES OF MARGIN REQUIREMENT CALCULATIONS

4.1 Example 1 Index-based futures portfolio

Portfolio A

- 5 short positions in FW20H6 futures

- 6 long positions in FW20M6 futures

- 1 long position in FW20U6 futures

- 4 long positions in OW20C6290 call options (strike price 2900), premium 116

- 10 short positions in OW20C6300 call options (strike price 3000), premium 63

- 1 short position in FMIDM6 futures

The margin calculation begins with determining the total risk value for the positions under a given scenario. The risk scenarios published by KDPW_CCP are used for this purpose. The risk scenarios contain risk values for a single long position. In order to obtain the actual risk values for positions in the portfolio, the risk value published by KDPW_CCP should be multiplied by the number of positions in a given instrument.

Table 3-1 Calculating risk scenarios for positions within a portfolio

Scenario no	OW20C6300		
	Risk in a single long position	Number of positions	Total risk
	[1]	[2]	[3] = [2] x [1]
1	-191	-10	1 910
2	209	-10	-2 090
3	-429	-10	4 290
4	-12	-10	120
5	10	-10	-100
6	373	-10	-3 730
7	-704	-10	7 040
8	-294	-10	2 940
9	175	-10	-1 750
10	484	-10	-4 840

11	-1015	-10	10 150
12	-632	-10	6 320
13	306	-10	-3 060
14	554	-10	-5 540
15	-1081	-10	10 810
16	200	-10	-2 000

Table 3-2 Calculating the margin for scenario risk for a portfolio

Scenario no.	Price variation	Volatility variation	Weights	FW20H6	FW20M6	FW20U6	OW20C6290	OW20C6300	W20 class	FMIDM6	MID class
1	0	1	1	0	0	0	-752	1 910	1 158,00	0	0
2	0	-1	1	0	0	0	840	-2 090	-1 250,00	0	0
3	0.33	1	1	2 500	-3 000	-500	-1 992	4 290	1 298,00	367	367
4	0.33	-1	1	2 500	-3 000	-500	-500	120	-1 380,00	367	367
5	-0.33	1	1	-2 500	3 000	500	344	-100	1 244,00	-367	-367
6	-0.33	-1	1	-2 500	3 000	500	1 960	-3 730	-770,00	-367	-367
7	0.67	1	1	5 000	-6 000	-1 000	-3 360	7 040	1 680,00	733	733
8	0.67	-1	1	5 000	-6 000	-1 000	-2 024	2 940	-1 084,00	733	733
9	-0.67	1	1	-5 000	6 000	1 000	1 300	-1 750	1 550,00	-733	-733
10	-0.67	-1	1	-5 000	6 000	1 000	2 852	-4 840	12,00	-733	-733
11	1.00	1	1	7 500	-9 000	-1 500	-4 848	10 150	2 302,00	1 100	1 100
12	1.00	-1	1	7 500	-9 000	-1 500	-3 704	6 320	-384,00	1 100	1 100
13	-1.00	1	1	-7 500	9 000	1 500	2 108	-3 060	2 048,00	-1 100	-1 100
14	-1.00	-1	1	-7 500	9 000	1 500	3 516	-5 540	976,00	-1 100	-1 100
15	3.00	0	0,32	7 200	-8 640	-1 440	-4 892	10 810	3 038,00	1 056	1 056
16	-3.00	0	0,32	-7 200	8 640	1 440	1 460	-2 000	2 340,00	-1 056	-1 056

In portfolio A, 2 classes of instruments can be distinguished: W20 and MID. The active risk scenario (i.e., the scenario containing the greatest loss) is Scenario 15 for the W20 class and Scenario 11 for class MID. The margin to cover scenario risk for both classes will therefore be set at PLN 3,038 and PLN 1,100 respectively.

In order to calculate the other components of the margin requirement, the value of the delta in each level will need to be determined. The value of the delta in each level is calculated on the basis of information on the value of the reference delta for each instrument published by KDPW_CCP, as well as on the basis of level definitions.

Table 3-3 Reference delta values for each instrument within the portfolio

Instrument	FW20H6	FW20M6	FW20U6	OW20C6290	OW20C6300	FMIDM6
Delta	1	1	1	0.591014	0.41955	1

Table 3-4 Level definitions for W20 class

Level no.	No. of subsequent expiry month
Level 1	1 (futures)
Level 2	2 (futures)
Level 3	3 (futures)
Level 4	options

Futures contracts are assigned to levels on the basis of their expiry dates while options are assigned to levels that cover the so-called underlying month. This means in practice that all index-based options are assigned to a level which covers the technical "month" – "999999".

On the basis of this information, the value of the delta for each month is calculated. E.g., the value of the delta for OW20C6290 is obtained by multiplying the number of positions (4) by the value of the delta (0.591014) and by the delta scaling factor (4 x 0.591014 x10 =23.6406).

The delta scaling factor takes into account potential differences in the nominal value of futures contracts.

Table 3-5 Calculating the delta for each month

Name of instrument	FW20H6	FW20M6	FW20U6	OW20C6290	OW20C6300	FMIDM6
Delta month	200603	200606	200609	999999	999999	200606
Delta scaling factor	10	10	10	10	10	10
Delta value	-50	60	10	23.6406	-41.9550	-10

In the next step, the value of the net delta in each month is calculated. Here is an example of calculation for "level 4".

999999: 23.6406 + (-41.9550) = 18.3144

Following the calculation of the net deltas for each month, the total of net positive deltas and the total of net negative deltas for each level is calculated.

The values of the deltas allocated to each level for the W20 class are as follows:

Table 3-6 Delta in levels

W20 class		
Level no.	Positive delta	Negative delta
Level 1		-50.0000
Level 2	60.0000	
Level 3	10.0000	
Level 4		-18.3144

The value of the margin for intra-class spread is calculated using the spread definition.

Table 3-7 Intra-class spread definition

Class	Priority	Leg 1	Market side	Leg 2	Market side	Margin
W20	1	1N1	A	1N2	B	20
	2	1N1	A	1N3	B	25
	3	1N2	A	1N3	B	25
	4	1N1	A	1N4	B	25
	5	1N2	A	1N4	B	25
	6	1N3	A	1N4	B	25

The spreads need to be created according to pre-defined priorities only. A delta "used" to create a spread lowers the value of the delta available for spreads with lower priorities. The notation "1N1" means that in order to create a leg of a spread, 1 delta from level 1 will need to be used. The notation "1N2" means that in order to create a leg of a spread, 1 delta from level 2 will need to be used, and so forth. A spread may be created when the deltas in each leg of the spread are situated on specific market sides. In such instances, if one leg of the spread is a positive position in the delta, then the other leg must be a negative position, and vice versa, which corresponds to the designated symbols A and B.

Table 3-8 Delta in the spread

Priority	Leg 1	Leg 2	Delta in the spread
1	-50.0000	60.0000	50.0000

Priority	Leg 1	Leg 2	Delta in the spread
2	0.0000	10.0000	0.0000

Priority	Leg 1	Leg 2	Delta in the spread
3	10.0000	10.0000	0.0000

Priority	Leg 1	Leg 2	Delta in the spread
4	0.0000	-18.3144	0.0000

Priority	Leg 1	Leg 2	Delta in the spread
5	10.0000	-18.3144	10.0000

Priority	Leg 1	Leg 2	Delta in the spread
6	10.0000	-8.3144	8.3144

For priority 1, both legs of the spread are on opposite market sides and it is possible to create the following spread:

Min(|-50.0000/1|;|60.0000/1|) = 50.0000.

At the same time, the value of the delta available to create subsequent spreads will be:

For level 1: -50.0000 - (- 50.0000) = 0

For level 2: 60.0000 – 50.0000 = 10.0000

For priority 2, the first leg of the spread has a delta value of 0.0000 while the second leg has a value of 10.0000. It is therefore not possible to create a spread.

For priority 3, the first leg of the spread has a delta value of 10.0000 while the second leg also has a value of 10,0000. It is therefore not possible to create a spread.

For priority 4, the first leg of the spread has a delta value of 0.0000 while the second leg has a value of -18.3144. It is therefore not possible to create a spread.

For priority 5, the first leg of the spread has a delta value of 10.0000 while the second leg has a value of -18.3144 and it is therefore possible to create the following spread:

min(|10.0000/1|;|-18.3144/1|) = 10.0000

At the same time, the value of the delta available to create new spreads will equal:

For level 2: 10.0000 – 10.0000 = 0

For level 4: -18.3144 - (-10.0000) = -8.3144

For priority 6, the first leg of the spread has a delta value of 10.0000 while the second leg has a value of -8.3144 and it is therefore possible to create the following spread:

min(|10.0000/1|; |-8.3144/1|) = 8.3144.

At the same time, the value of the delta available to create new spreads will equal:

For level 3: 10.0000 – 8.3144 = 1.6856

For level 6: - 8.3144 - (-8.3144) = 0

The final value of the intra-class spread margin for the W20 class is calculated as follows:

50.0000 x 20 + 0.0000 x 25 + 0.0000 x 25 + 0.0000 x 25 + 0.0000 x 25 + 10.0000 x 25 + 8.3144 x 25 = PLN 1,458

The intra-class spread margin for class MID will total PLN 0 because it is not possible to create any spread in this class (the portfolio only contains a single futures position).

Next, the inter-class spread margin will need to be calculated. The definition of inter-class spread will need to be applied.

Table 3-9 Inter-class spread definition

Priority	Credit rate	Leg 1 / class code	Delta number	Market side	Leg 2 / class code	Delta number	Market side
+1	70%	W20	1	A	MID	1	B

The aforementioned definition means that for each spread formed between classes WIG20 and MID (for both legs of the spread), a rate of 70% will be applied.

In order to calculate the level of the credit rate, the unit price variation risk will need to be set.

For class W20, the calculation is performed as follows:

Scenario risk adjusted for volatility risk = (active scenario risk + paired scenario risk) / 2

(3,038 + 3,038) / 2 = 3,038

Time risk = (Scenario 1 risk + Scenario 2 risk) / 2

(1,158 + (-1,250)) / 2 = -46

Price variation risk = Scenario change risk adjusted by volatility risk – time risk

(3,038 - (-46)) = 3,084

The value of the net delta in the whole W20 class amounts to 1.6856 (the total of long and short positions expressed in the delta).

The value of unit price variation risk is calculated as follows:

Unit price variation risk = Price variation risk / total net delta

(3,084/ 1.6856) = 1,829.62

For the MID class, the calculations are as follows:

Scenario risk adjusted by volatility risk =(active scenario risk + paired scenario risk) / 2

(1100 + 1100) / 2 = 1100

Time risk = (Scenario 1 risk + Scenario 2 risk) / 2

(0 + 0) / 2 = 0

Price variation risk = Scenario change risk adjusted by volatility risk – time risk

(1100 – 0) = 1100

The value of the net delta for the whole MID class is equal to -10 (the sum total of long and short positions within the delta)

The value of unit price variation risk is calculated as follows:

Unit price variation risk = Price variation risk / total net delta value

(1100 / 10) = 110

In the next step, the number of deltas in the inter-class spread will need to be calculated.

This figure is calculated as follows:

min (|1.6856|; |-10|) = 1.6856

The final value of the spread credit is calculated according to the following formula:

Credit value = Unit price variation risk x delta in the spread x number of deltas x credit rate

Calculating the value of the credit for W20

(1,829.62 x 1.6856 x 1 x 70%) = PLN 2,159

Calculating the value of the credit for the MID class

(110 x 1.6856 x 1 x 70%) = PLN 130

Another element which needs to be included in calculations is the minimum margin for short positions in options (Formula 1-1)

Table 3-10 Minimum margin for options

Class	Minimum margin for short positions in options
W20	10

Minimum margin = 10 x 10 = PLN 100

Margin requirement for class W20 is calculated as follows:

(Formula 1-2):

max(3,038 + 1,458 – 2,159 ; 100) = 2,337

In the next step, the value of balances for net positions in options will need to be included. The value of short positions will be partially offset by the value of long positions; the balance of net positions in options will be calculated as follows:

4 x 10 x 116 + (-10 x 10 x 63) = -1,660

The value of the margin requirement after incorporating the value of the options balance will therefore equal: (Formula 1-3):

Max(2,337 - (- 1,660);0) = 3,997

The final margin for class W20 will therefore equal PLN 3,997.

Since the balance $\left(DZW_{pk} - PNO_{pk}\right)$ for the class is positive, then $NOD_{pk} = 0$, which means that no value will be used to offset the risk in other classes.

The margin requirement for class MID is calculated as follows (Formula 1-2):

max(1,100 + 0 − 130; 0) = PLN 970

Since there are no positions in options within a given class and no excess of long positions from class W20 will be used to offset the risk, this amount will constitute the total margin requirement for the class.

The margin requirement for the portfolio is calculated as follows (Formula 1-5):

(3,997 + 970) = **PLN 4,967**

4.2 Example 2 Bond basket futures portfolio

Portfolio B
- 2 short positions in FPS5H6 futures
- 1 long position in FPS5M6 futures

Table 3-11 Calculating margins for scenario risk

Scenario no.	Price variation	Volatility variation	Weight	FPS5H6	FPS5M6	PS5 class
1	0	1	1	0	0	0
2	0	-1	1	0	0	0
3	0.33	1	1	1 333	-667	666
4	0.33	-1	1	1 333	-667	666
5	-0.33	1	1	-1 333	667	-666
6	-0.33	-1	1	-1 333	667	-666
7	0.67	1	1	2 667	-1 333	1 334
8	0.67	-1	1	2 667	-1 333	1 334
9	-0.67	1	1	-2 667	1 333	-1 334
10	-0.67	-1	1	-2 667	1 333	-1 334
11	1.00	1	1	4 000	-2 000	2 000

12	1.00	-1	1	4 000	-2 000	2 000
13	-1.00	1	1	-4 000	2 000	-2 000
14	-1.00	-1	1	-4 000	2 000	-2 000
15	3.00	0	0,32	3 840	-1 920	1 920
16	-3.00	0	0,32	-3 840	1 920	-1 920

Portfolio B contains only 1 class of instruments: PS5. The active risk scenario (i.e., the scenario which envisages the greatest loss) is Scenario 11. The scenario risk equals PLN 2,000.

The value of the reference delta for futures is equal to 1. The value of the scaling factor is also equal to 1.

On the basis of this information, the value of the delta for each month is calculated. For example, the value of the delta for FPS5H6 is obtained by multiplying the number of positions (-2) by the value of the delta (1) and by the delta scaling factor (1). The sum obtained is: -2 (-2 x 1 x 1 = -2).

Table 3-12 Calculating deltas for each month

Name of instrument	FPS5H6	FPS5M6
Delta month	200603	200606
Delta scaling factor	1	1
Delta value	-2	1

For the PS5 class, a specific spread type has been determined: 1T1, which means that one level is selected, which covers all the months when expiry takes place.

Table 3-13 Intra-class spread definition

Class	Priority	Leg 1	Market side	Leg 2	Market side	Margin
PS5	1	1T1	A	1T1	B	200

The aggregated delta values and the number of deltas in the spread for the PS5 class are as follows:

Table 3-14 Delta in the level

PS5 class			
Level no.	Negative delta	Positive delta	Delta in the spread
Level 1	-2	1	1

In this instance, only one spread has been defined which may be created when the deltas in each leg of the spread are on opposing market sides. In this case, if one leg of the spread is a positive position

in the in the delta, then the second leg must be a negative position and vice versa, which corresponds to symbols A and B.

For priority 1, one leg of the spread has a delta value of -2 while the other a value of 1. It is therefore possible to create the following spread:

min(|-2/1|; |1/1|) = 1.

The final intra-class spread margin for the PS5 class is calculated as follows:

1 x 200 = PLN 200

Next, the delivery margin will need to be calculated. For the purposes of this example, it is assumed that at any given time of calculation, the delivery margin is required in respect of positions in FPS5H6. The levels of delivery margin are set by KDPW_CCP.

Table 3-15 Delivery margin for class PS5

Spread positions	PLN 1700
Unsecured positions	PLN 2000

The delivery margin for spread positions is calculated using the definition of intra-class spread. Since an earlier calculation showed that the spread contained a position equal to 1 delta, the delivery margin for spread positions is calculated as follows:
(1 x 1700 = PLN 1700)

After creating the spread, an unsecured position with the value of 1 delta (short position) will remain; it is therefore essential to calculate the delivery margin for unsecured positions:
(1 x 2000 = PLN 2000)

Table 3-16 Calculating the margin requirement

Risk scenario margin	2 000
Intra-class spread margin	200
Delivery margin (spread positions)	1 700
Delivery margin (unsecured positions)	2 000
Total	5 900

The final margin value for the PS5 class equals PLN 5,900.

5 GLOSSARY

Class
A set of instruments with the same underlying instrument.

Delta
One of the so-called Greek co-efficients, expressing the sensitivity of the option premium to price variations of the underlying instrument; depending on the type of option and the market side, its value may be expressed within the limits (-1;1).

Delta scaling factor
A number multiplied by the delta value. It is used to reflect differences between the nominal values of derivatives contracts.

Derivatives portfolio
A set of positions registered on a clearing account of a given clearing member.

Clearing account
An account with the following attributes: institution code, ownership type, participation type, representative agreement id no., type of account, client id no. (NKK) and portfolio

Level
A set of months in which derivatives expire. Used when creating intra-class spreads.

Long position excess
A situation where a positive balance of net option values within a given class is higher than the value of the required margin in that class. The long position excess is used to offset risk in other portfolio classes.

Net option value
Net balance of the market value of options in the portfolio.

Premium

The option price – market or theoretical price; KDPW_CCP calculates the theoretical value of the premium for a range of risk scenarios in order to determine the risk and margin requirements. Reference volatility is used for this purpose.

Price risk
The risk of change in the price of financial instruments after excluding the effect of time risk and volatility.

Reference delta

The mean weighted delta calculated for a given financial instrument. The calculations assume the passage of time and the realisation of 1 out of 7 price variation scenarios. The probability of the realisation of each scenario is weighted accordingly.

Risk parameters

A set of parameters defined and made available by KDPW_CCP, used to calculate margins with SPAN® methodology.

Risk scenarios

A range of 16 scenarios reflecting price variations and volatility, used to calculate margins. KDPW_CCP makes the risk scenarios for all derivatives it clears available each day.

Spread

A set of two (spread with two legs) or more positions defined by KDPW_CCP. Used to calculate margins and credit.

Time risk

The risk of the change in the value of the option premium as a result of the progress of time. Taken into account when calculating inter-class spread credit.

Volatility

It may be expressed in several ways:
- as historical volatility of the underlying instrument,
- as volatility implied by the market price of the option,
- as reference volatility determined by KDPW_CCP on the basis of pre-defined criteria.

Volatility risk

The risk of change in the value of the option premium related to the variation in volatility of the underlying instrument.