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SPAN® METHODOLOGY CASH MARKET

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1 INTRODUCTION

This document describes the methodology used to calculate margin requirements for clearing members operating in the regulated cash market, cleared by KDPW_CCP. Margin deposits calculated for the cash market are used to secure any losses which may be due when closing the position of an insolvent clearing member with outstanding obligations to KDPW_CCP.
The approved methodology is SPAN® Liquidation Risk.

The margin required to be posted by the clearing member consists of two elements:

- Margin to secure against liquidation risk
- Marking to market margin.

The margin used to secure against liquidation risk is calculated using SPAN® methodology for cash market instruments. SPAN® is a trademark of the Chicago Mercantile Exchange. The Chicago Mercantile Exchange accepts no liability in connection with the use of SPAN® by any individual or entity.
The SPAN® liquidation risk add-on is a hedge against losses in clearing accounts of KDPW_CCP participants which may arise due to adverse changes of prices of instruments in the expected liquidation window with significant probability. The SPAN liquidation risk methodology is based on the calculation of market risk, intra-class spread deposits and inter-class spread credits. To perform calculations for positions recorded in an account, positions are grouped into positions in equities (and equivalents) and positions in debt instruments (bonds). Positions in equities are allocated to liquidity classes; positions in debt are allocated to duration classes.
Classes are identified depending on the applicability of uniform risk hedging methods to instruments uniform in risk.

Marking to market for spot transactions mitigates market risk owing to collateral available to cover the difference between the current reference price of the instrument and the transaction price (equivalent to marking to market for futures).

2 LIQUIDATION RISK

2.1 Calculating risk for securities other than debt securities

Risk calculation is performed at the level of the portfolio (clearing account). At this level, a net buy or a net sell position is determined for each instrument.
The calculations only include those transactions for which clearing is guaranteed and which are to be found in the clearing cycle.

2.1.1 Assigning equities to liquidity classes

A liquidity class is a set of instruments that are positioned within a given liquidity category, for which KDPW_CCP applies uniform risk parameters.

The algorithm used to assign instruments to a given class takes into account average liquidity and the instrument type. KDPW_CCP reserves the right to change the assignment of an instrument to a particular class. A complete specification of liquidity classes is made available to members at the end of day.

Example:

Table 1-1 Assigning equities to liquidity classes

ISIN	Liquidity class
PLAKCJA00001	LQPLN1
PLAKCJA00002	LQPLN1
PLAKCJA00003	LQPLN1
PLAKCJA00024	LQPLN2
PLAKCJA00025	LQPLN2
PLAKCJA00036	LQPLN3
PLAKCJA00037	LQPLN3
PLAKCJA00048	LQEUR1

2.1.2 Determining the basis for calculation

The lowest level at which calculations are made for margin requirements is the liquidity class level within the portfolio. A portfolio in the cash market is a set of positions in the clearing cycle (transactions already executed within the stock exchange system, however, pending clearing in KDPW_CCP), distinguished by having the same clearing account.

2.1.3 Calculating net positions by instrument

Within the portfolio, buy and/or sell transactions involving a set number of instruments assigned to various liquidity classes may be registered for each instrument.
The value of positions in a given instrument is calculated by multiplying the number of net instruments by the reference price in PLN (the closing price adjusted following a corporate action event multiplied by the exchange rate of the listing currency).
Adding together the values of calculated positions in each instrument within a given class provides the value of the buy position (PK) and the value of the sell position (PS).

Table 1-2 Calculating PK and PS for liquidity classes.

Liquidity class	Instrument	Market side (B/S)	Number of instruments	Price in the listing currency	Reference price in PLN	PK in PLN	PS in PLN
LQPLN1	PLAKCJA00001	B	1500	23,2 PLN	23.2	34 800.00	0.00
	PLAKCJA00002	B	200	62,9 PLN	62.9	12 580.00	0.00
	PLAKCJA00003	S	100	148,5 PLN	148.5	0.00	14 850.00
Total LQPLN1						47 380.00	14 850.00
LQPLN2	PLAKCJA00024	B	500	6,25 PLN	6.25	3 125.00	0.00

	PLAKCJA00025	S	2000	5,55 PLN	5.55	0.00	11 100.00
Total LQPLN2						3 125.00	11 100.00
LQPLN3	PLAKCJA00036	B	600	31,3 PLN	31.3	18 780.00	0.00
	PLAKCJA00037	S	800	34 PLN	34	0.00	27 200.00
Total LQPLN3						18 780.00	27 200.00
LQEUR1	PLAKCJA00048	S	200	11,17 EUR	44.68	0.00	8 936.00
Total LQEUR1						0.00	936.00

2.1.4 Total net position by liquidity class

The *total net position is* calculated for the liquidity class as the absolute value of the difference between the total value of buy positions and the total value of sell positions.

Calculating the total net position for portfolio *p* in a given class *k*:

$$\boldsymbol{CPN_{pk} = \left|PK_{pk} - PS_{pk}\right|} \qquad \textbf{Formula 1-1}$$

where:

CPN_{pk} – total net position for portfolio *p* in class *k*
PK_{pk} – total of values of buy positions for portfolio *p* for class *k*
PS_{pk} – total of values of sell positions for portfolio *p* for class *k*
p – index of the portfolio of a given clearing member
k – liquidity class index

Table 1-3 Total net position

Liquidity class	PK	PS	|PK-PS|
LQPLN1	47 380.00	14 850.00	32 530.00
LQPLN2	3 125.00	11 100.00	7 975.00
LQPLN3	18 780.00	27 200.00	8 420.00
LQEUR1	0.00	8 936.00	936.00

2.1.5 Total gross position by liquidity class

The *total gross position* is calculated for a liquidity class as the sum of the total values of buy positions and the total the values of sell positions.

Calculating the total gross position for a given portfolio *p* in class *k*:

$$\boldsymbol{CPB_{pk} = PK_{pk} + PS_{pk}} \qquad \textbf{Formula 1-2}$$

where:

$\boldsymbol{CPB_{pk}}$- total gross position for portfolio *p* in class *k*

Table 1-4 Total gross position

Liquidity class	PK	PS	PK+PS
LQPLN1	47 380.00	14 850.00	62 230.00
LQPLN2	3 125.00	11 100.00	14 225.00
LQPLN3	18 780.00	27 200.00	45 980.00
LQEUR1	0.00	8 936.00	936.00

2.1.6 Calculating intermediary liquidation risk

Intermediary liquidation risk is calculated on the basis of the value of market risk and specific risk at the level of each liquidity class within the portfolio.

2.1.7 Market risk

Market risk involves the risk of a variation in the price of instruments within a given liquidity class. The co-efficient y_k is used to calculate the margin to cover market risk. This co-efficient is determined by KDPW_CCP for each liquidity class separately.

The *market risk margin* is calculated according to the following formula:

$$\boldsymbol{DRR_{pk} = y_k \times \left|PK_{pk} - PS_{pk}\right|} \qquad \textbf{Formula 1-3}$$

where:

DRR_{pk} - margin for market risk for portfolio *p* in class *k*

y_k - level of market risk for class *k*

2.1.8 Specific risk

Specific risk involves the risk of price variation of a given instrument away from the norm for a given liquidity class, as a result of its particular characteristics. The co- efficient x_k is used to calculate the margin to cover specific risk. This co-efficient is determined by KDPW_CCP for each liquidity class separately.

The *specific risk margin* is calculated according to the following formula:

$$\boldsymbol{DRS_{pk} = x_k \times \left(PK_{pk} + PS_{pk}\right)} \qquad \textbf{Formula 1-4}$$

where:

DRS_{pk} - margin for specific risk for portfolio *p* in class *k*

x_k - level of specific risk for class *k*

2.1.9 Intermediary liquidation risk

The value of the *intermediary liquidation risk* for portfolio *p* in class *k* is the sum of the values of the specific risk and market risk.

The *intermediary liquidation risk margin* is calculated on the basis of the following formula:

$$\boldsymbol{DPLR_{pk} = DRR_{pk} + DRS_{pk}} \qquad \textbf{Formula 1-5}$$

$DPLR_{pk}$- margin for intermediary liquidation risk for portfolio *p* in class *k*

Table 1-5 Examples of the values of the co-efficients *y* and *x*

Liquidity class	y (market risk)	x (specific risk)
LQPLN1	5%	3%
LQPLN2	7%	4%
LQPLN3	7%	4%
LQEUR1	10%	5%

Table 1-6 Examples of the calculation of margin values for intermediary liquidation risk

Liquidity class	y % [1]	x % [2]	Net position [3]	Gross position [4]	Market risk [5]=[1]*[3]	Specific risk [6]=[2]*[4]	Intermediary risk [7]=[5]+[6]
LQPLN1	5%	3%	32 530.00	62 230.00	1 626.50	1 866.90	3 493.40
LQPLN2	7%	4%	7 975.00	14 225.00	558.25	569.00	1 127.25
LQPLN3	7%	4%	8 420.00	45 980.00	589.40	1 839.20	2 428.60
LQEUR1	10%	5%	8 936.00	8 936.00	893.60	446.80	1 340.40

2.1.10 Calculating the inter-class spread credit

The *inter-class spread credit* allows the reduction of the intermediary liquidation risk by acknowledging the correlation between various liquidity classes.

In order to calculate the value of the *inter-class spread credit*, the *crt* parameter and the value of the *total net position* for each class are determined by KDPW_CCP.

In order to calculate the credit, KDPW_CCP defines a *credit spread priority table*.

The credit may be assigned exclusively to *overall net positions* which have opposite sides in the market, i.e., the spread relates to two positions, of which one is a net buy position while the other is a net sell position.

This derives from the principle that a portfolio which holds net buy positions in one class and net sell positions in another class is less exposed to risk than a portfolio which has net positions in both classes on the same side of the market (in the event of a general market fall, the losses on net buy positions are partially offset by gains in net sell positions).

The credit is calculated according to the following formula:

$$\boldsymbol{KSPK(k_1; k_2)_p = -crt_{k_1/k_2} \times min\{CPN_{pk_1}; CPN_{pk_2}\}} \qquad \textbf{Formula 1-6}$$

where:

$KSPK(k_1; k_2)_p$- inter-class spread credit in portfolio *p* for class k_1 and k_2

crt_{k_1/k_2} - credit co-efficient for class k_1 and k_2

Principles:

- Overall net positions for class k_1 and k_2 must be on opposite sides.
- KDPW_CCP prepares a table of approved class pairs for which credit, the credit value and the order for crediting each pair is assigned.
- If within a given class there remains an overall net position for credit, the next opposite overall net position is sought according to the priority table defined by KDPW_CCP.

Note: the assigned inter-class spread credit relates to each leg of the spread Table 1-7 Spread priority table

Table 1-7 Spread priority table

Priority	Liquidity class *a*	Market side *a*	Liquidity class *b*	Market side *b*	Credit co-efficient
1	LQPLN1	A	LQPLN2	B	2.50%
2	LQPLN2	A	LQPLN3	B	3.50%
3	LQPLN1	A	LQPLN3	B	3.00%

Table 1-8 Net positions in liquidity classes

Liquidity class	Overall net buy position	Overall net sell position
LQPLN1	32 530.00	0.00
LQPLN2	0.00	7 975.00
LQPLN3	0.00	8 420.00
LQEUR1	0.00	8 936.00

Table 1-9 Positions available for spreads

Liquidity class	Overall net buy position			
	Positions available for priorities			
	1	2	3	remainder
LQPLN1	32 530.00	24 555.00	24 555.00	16 135.00
LQPLN2	0.00	0.00	0.00	0.00
LQPLN3	0.00	0.00	0.00	0.00
LQEUR1	0.00	0.00	0.00	0.00

Liquidity class	Overall net sell position			
	Positions available for priorities			
	1	2	3	remainder

LQPLN1	0.00	0.00	0.00	0.00
LQPLN2	7 975.00	0.00	0.00	0.00
LQPLN3	8 420.00	8 420.00	8 420.00	0.00
LQEUR1	8 936.00	8 936.00	8 936.00	8 936.00

Table 1-10 Credit value for spreads

Priority	Net buy position (B)	Net sell position (S)	Min(B;S)	Credit value
1 LQPLN1/LQPLN2	32 530.00	7 975.00	7 975.00	-199.38
2 LQPLN2/LQPLN3	0.00	8 420.00	0.00	0.00
3 LQPLN1/LQPLN3	24 555.00	8 420.00	8 420.00	-252.60

Table 1-11 Credit value for liquidity classes

Liquidity class	Credit value
LQPLN1	-451.98
LQPLN2	-199.38
LQPLN3	-252.60

2.1.11 Calculating the final liquidation risk

The *final liquidation risk* in portfolio *p* in class *k* is equal to the *intermediary liquidation risk* less the assigned credit relating to a given class.

The *margin for the final liquidation risk* is calculated according to the following formula:

$$\boldsymbol{DOLR_{pk} = DPLR_{pk} + KSPK_{pk}} \qquad \textbf{Formula 1-7}$$

where:

$DOLR_{pk}$ - margin for final liquidation risk in portfolio *p* in class *k*

$DPLR_{pk}$ - margin for intermediary liquidation risk for portfolio *p* in class *k*

$KSPK_{pk}$ - inter-class spread credit in portfolio *p* in class *k*

Table 1-12 Calculating the final liquidation risk

Liquidity class	Intermediary risk	Credit value	Final Liquidation Risk
LQPLN1	3 493.40	-451.98	3 041.43
LQPLN2	1 127.25	-199.38	927.88

LQPLN3	2 428.60	-252.60	2 176.00
LQEUR1	340.40	0.00	1 340.40
		All classes	**7 485.70**

2.2 Calculating risk for debt securities

Risk calculation is performed at the level of the portfolio. At this level, a net buy position or a net sell position may be held in each instrument.

2.2.1 Assigning debt securities to duration classes

Each debt security is assigned to a *duration class* on the basis of the listing currency, the country of the issuer, the value of its *modified duration* co-efficient and internal rating. Treasury bonds are assigned to separate duration classes. The assignment is made automatically at the end of day. KDPW_CCP reserves the right to change the assignment of a debt securities taking into account the risk profile. KDPW_CCP publishes information on the assignment of each debt securities to a duration class.
Example.

Table 1-13 Duration class table

Listing currency	Country of the issuer	Modified duration	Treasury bonds	Non-Treasury debt securities	Illiquid debt securities	equity bonds
PLN	Poland	(0,1)	DRPPL1	DRPPL4	DRPPLC	DRPPLZ
PLN	Poland	<1;4)	DRPPL2	DRPPL5		
PLN	Poland	<4;….)	DRPPL3	DRPPL6		
EUR	Poland	(0,1)	DREPL1	DREPL4	DREPLC	DREPLZ
EUR	Poland	<4;1)	DREPL2	DREPL5		
EUR	Poland	<4;….)	DREPL3	DREPL6		

Table 1-14 Assigning debt securities to a duration class

Instrument	Duration class
OK0116	DRPPL1
OK0716	DRPPL1
XYZOB0416	DRPPL1
PS0418	DRPPL2
PS0718	DRPPL2
IZ0823	DRPPL3
DS1020	DRPPL3
EUR0119	DREPL2

For the purpose of determining margins, the minimum modified duration is 0.5.

2.2.2 Determining the calculation base

The calculation base consists of positions recorded in a given portfolio and in a given duration class.

2.2.3 Valuing net positions by instrument

At the level of the portfolio, buy and/or sell transactions involving a set number of instruments within a given *duration class* may be registered for each instrument.
The value of positions in a given instrument is calculated by multiplying the number of instruments by the reference price in PLN (price in the listing currency multiplied by the exchange rate of the listing currency) and by the *modified duration* co-efficient provided by KDPW_CCP.
Adding together the values of calculated positions in each instrument within a given duration class provides the value of the buy position (PK) and the value of the sell position (PS).

Table 1-15 Calculating the value of positions within a duration class

Instrument	Market side (B/S)	Number of instruments	Modified duration	Price in the listing currency	Reference price in PLN	PK in PLN	PS in PLN
OK0116	K	100	0,52	973,38 PLN	973,38	50 615,76	0
OK0716	K	15	0,84	961,62 PLN	961,62	12 116,41	0
XYZOB0416	S	10	0,84	962,5 PLN	962,5	0	8 085
						62 732,17	**8 085**
PS0418	K	50	2,25	1029,5 PLN	1029,5	115 818,75	0
PS0718	S	100	2,88	1041,0 PLN	1041	0	299 808
						115 818,75	**299 808**
IZ0823	K	50	7,24	1101,0 PLN	1101	398 562	0
DS1020	S	90	4,11	1049,5 PLN	1049,5	0	388 210,05
						398 562	**388 210,05**
EUR0119	S	10	3,5	1000 EUR	4000	0	140 000,00
						0	**140 000,00**

2.2.4 Total net position by duration class

The *total net position* is calculated for the *duration class* as the absolute value of the difference between the total value of buy positions and the total value of sell positions.
Calculating the *total net position* for portfolio *p* in a given class *k*:

$$\boldsymbol{CPN_{pk} = \left|PK_{pk} - PS_{pk}\right|} \qquad \textbf{Formula 1-8}$$

where:
CPN_{pk} – total net position for portfolio *p* in class *k*
PK_{pk} – total of values of buy positions for portfolio *p* for class *k*
PS_{pk} – total of values of sell positions for portfolio *p* for class *k*

p – index of the portfolio of a given clearing member
k – duration class index

Table 1-16 Calculating the net position

Duration class	PK	PS	PK-PS	|PK-PS|
DRPPL1	62 732,17	8 085	54 647,17	54 647,17
DRPPL2	115 818,75	299 808	-183 989,25	183 989,25
DRPPL3	398 562	388 210,05	10 351,95	10 351,25
DREPL2	0,00	140 000,00	-140 000,00	140 000,00

2.2.5 Total gross position by duration class

The *total gross position* is calculated for a duration class as the sum of the total values of buy positions and the total values of sell positions.

Calculating the *total gross position* for a given portfolio *p* in class *k*:

$$\boldsymbol{CPB_{pk} = PK_{pk} + PS_{pk}} \qquad \textbf{Formula 1-9}$$

where:
$\boldsymbol{CPB_{pk}}$- total gross position for portfolio *p* in class *k*

Table 1-17 Total gross position

Duration class	PK	PS	PK+PS
DRPPL1	62 732,17	8 085	70 817,17
DRPPL2	115 818,75	299 808	415 626,75
DRPPL3	398 562	388 210,05	786 772,05
DREPL2	0,00	140 000,00	140 000,00

2.2.6 Calculating intermediary liquidation risk

Intermediary liquidation risk is calculated on the basis of the value of market risk and specific risk at the level of each duration class within the portfolio.
The calculations only include those transactions with a clearing guarantee and awaiting clearing.

2.2.7 Market risk

Market risk involves the risk of an even shift of the yield curve within a given duration class. The co-efficient y_k is used to calculate the margin to cover market risk. This co-efficient is determined by KDPW_CCP for each duration class separately.

The *market risk margin* is calculated according to the following formula:

$$\boldsymbol{DRR_{pk} = y_k \times \left|PK_{pk} - PS_{pk}\right|} \qquad \textbf{Formula 1-10}$$

where:

DRR_{pk} - margin for market risk for portfolio *p* in class *k*

y_k - level of market risk for class *k*

2.2.8 Specific risk

Specific risk involves the risk of price variation of a given instrument away from the norm for a given duration class as a result of its particular characteristics. The co- efficient x_k is used to calculate the margin to cover specific risk. This co-efficient is determined by KDPW_CCP for each duration class separately.

The *specific risk margin* is calculated according to the following formula:

$$\boldsymbol{DRS_{pk} = x_k \times \left(PK_{pk} + PS_{pk}\right)} \qquad \textbf{Formula 1-11}$$

where:

DRS_{pk} - margin for specific risk for portfolio *p* in class *k*

x_k - level of specific risk for class *k*

2.2.9 Intermediary liquidation risk

The value of the *intermediary liquidation risk* for portfolio *p* in class *k* is the sum of the values of the specific risk and market risk.

The *intermediary liquidation risk margin* is calculated on the basis of the following formula:

$$\boldsymbol{DPLR_{pk} = DRR_{pk} + DRS_{pk}} \qquad \textbf{Formula 1-12}$$

$DPLR_{pk}$- margin for intermediary liquidation risk for portfolio *p* in class *k*

Table 1-18 Examples of the values of the co-efficients *y* and *x*

Duration class	y (market risk)	x (specific risk)

DRPPL1	0.15%	0.30%
DRPPL2	0.20%	0.35%
DRPPL3	0.20%	0.40%
DREPL2	0,20%	0,40%

Table 1-19 Examples of the calculation of margin values for intermediary liquidation risk

Duration class	y % [1]	x % [2]	Total net position [3]	Total gross position [4]	Market risk [5]=[1]*[3]	Specific risk [6]=[2]*[4]	Intermediary risk [7]=[5]+[6]
DRPPL1	0.15%	0.30%	54 647,17	70 817,17	81,97	212,45	294,42
DRPPL2	0.20%	0.35%	183 989,25	415 626,75	367,98	1 454,69	1 822,67
DRPPL3	0.20%	0.40%	10 351,25	786 772,05	20,70	3 147,09	3 167,79
DREPL2	0,20%	0,40%	140 000,00	140 000,00	280,00	560,00	840,00

2.2.10 Calculating the intra-class spread margin

The *intra-class spread margin* is calculated in order to counter exposure to risk of an uneven shift of the yield curve for a given duration class. The margin is calculated in relation to both positions determining the spread within a given class (PK and PS).
The intra-class spread margin is calculated according to the following formula:

$$\boldsymbol{DSWK_{pk} = dep_k \times min\{|PK_{pk}|; |PS_{pk}|\}} \qquad \textbf{Formula 1-13}$$

where:
$DSWK_{pk}$- margin for intra-class *k* spread
dep_k - level of margin for intra-class *k* spread

Table 1-20 Margin for intra-class spread

Duration class	Margin for intra-class spread
DRPPL1	0.15%
DRPPL2	0.20%
DRPPL3	0.20%
DREPL2	0,20%

Table 1-21 Calculating the margin for intra-class spread

Duration class	Min(|PK|;|PS|)	Margin for spread
DRPPL1	8 085	12,13
DRPPL2	115 818,75	231,64
DRPPL3	388 210,05	776,42
DREPL2	0,00	0,00

2.2.11 Calculating the inter-class spread credit

The *inter-class spread credit* allows the reduction of the *intermediary liquidation risk* by acknowledging the correlation between various duration classes.

The credit may be assigned exclusively to overall net positions which have opposite sides in the market, i.e., the spread relates to two positions, of which one is a net buy position while the other is a net sell position.

This derives from the principle that a portfolio which holds net buy positions in one class and net sell positions in another class is less exposed to risk than a portfolio which has net positions in both classes on the same side of the market (in the event of a general market fall, the losses on net buy positions are partially offset by gains in net sell positions).

The credit is calculated according to the following formula:

$$\boldsymbol{KSPK(k_1;k_2)_p = -crt_{k_1/k_2} \times min\{CPN_{pk_1}; CPN_{pk_2}\}} \qquad \textbf{Formula 1-14}$$

where:

$KSPK(k_1;k_2)_p$ - inter-class spread credit in portfolio *p* for class k_1 and k_2

crt_{k_1/k_2} - credit co-efficient for class k_1 and k_2

Principles:

- Overall net positions for class k_1 and k_2 must be on opposite sides.
- KDPW_CCP prepares a table of approved class pairs for which credit, the credit value and the order for crediting each pair is assigned.
- If within a given class there remains an overall net position for credit, the next opposite overall net position is sought according to the priority table defined by KDPW_CCP.

Note: the assigned credit for inter-class spread credit relates to each leg of the spread

Table 1-22 Credit coefficient for duration classes

Priority	Duration class *a*	Market side *a*	Duration class *b*	Market side *b*	Credit co-efficient
1	DRPPL2	A	DRPPL3	B	0.10%

Table 1-23 Determining net position in classes

Liquidity class	Overall net buy position	Overall net sell position
DRPPL2	0,00	183 989,25
DRPPL3	10 351,25	0,00

Table 1-24 Calculating credit values

Priority	Overall net buy position (B)	Overall net sell position (S)	Min(B;S)	Credit value
1 DRPPL2/DRPPL3	10 351,25	183 989,25	10 351,25	-10,35

2.2.12 Calculating the final liquidation risk

The final liquidation risk margin in portfolio *p* in class *k* is equal to the *intermediary liquidation risk margin* for a given class less the assigned credit relating to a given class plus the necessary margin for the spread in a given class.

$$\boldsymbol{DOLR_{pk} = DPLR_{pk} + KSPK_{pk} + DSWK_{pk}} \qquad \textbf{Formula 1-15}$$

where:

$DOLR_{pk}$ - margin for final liquidation risk in portfolio *p* in class *k*

$DPLR_{pk}$ - margin for intermediary liquidation risk for portfolio *p* in class *k*

$KSPK_{pk}$ - inter-class spread credit in portfolio *p* in class *k*

$DSWK_{pk}$ - margin for intra-class *k* spread credit in portfolio *p*

Table 1-25 Calculating the final liquidation risk

Duration class	Intermediary risk	Spread margin	Spread credit	Final liquidation risk
DRPPL1	294,42	12,13	0,00	306,55
DRPPL2	1 822,67	231,64	-10,35	2 043,96
DRPPL3	3 167,79	776,42	-10,35	3 933,86
DREPL2	840,00	0,00	0,00	840,00
All classes				7 124,37

3 MARKING TO MARKET MARGIN

3.1 Marking to market

Marking to market is the process of calculating the value of positions in the clearing cycle revalued using existing market prices less the clearing value based on executed transactions. Marking to market is only calculated for transactions within the clearing cycle.

Marking to market calculation for portfolio *p*, instrument *i*:

$$\boldsymbol{WR_{pi} = \left(WROZ_{pi} \times EN_i + \left(B_{pi} - S_{pi}\right) \times c_i \times EN_i + \left(BPD_{pi} - SPD_{pi}\right) \times d_i \times ED_i\right)}$$

Formula 2-1

where:

WR_{pi} – marking to market for portfolio *p*, security *i*

$WROZ_{pi}$ – the number of securities *i* bought/sold for portfolio *p* multiplied by the unit price of the transaction (for buy transactions, this is a negative number)

$B_{pi}; S_{pi}$ – number of securities bought/sold

$BPD_{pi}; SPD_{pi}$ –number of purchased/sold securities with the right to dividend/coupon

c_i – securities reference price

d_i – dividend/coupon amount as of a payment day; if reference price c_i is the price of a security with the right to purchased/sold dividend/coupon, then $d_i = 0$

ED_i – exchange rate of the currency of the dividend/coupon

EN_i – exchange rate of the listing currency

For net buy balances, where $B_{pi} > S_{pi}$, the buy reference price is used $c_i = ck$

For net sell balances, where $B_{pi} < S_{pi}$ the sell reference price is used $c_i = cs$

3.2 Calculating the buy and sell reference price

The reference price used in the marking to market calculation may be corrected on the basis of a list of parameters. The purpose of a price correction is to secure the marking to market for a given security. For net buy balances, downward price corrections are used, while for net sell balances, upward price corrections are used.

The following scenarios are possible:

1. The security was quoted on the date of calculation
   - the percentage price variation in relation to the previous reference price exceeds *n%*

$$\boldsymbol{ck = co \times (1 - cd_1)} \qquad \textbf{Formula 2-2}$$

$$\boldsymbol{cs = co \times (1 + cu_1)} \qquad \textbf{Formula 2-3}$$

where:

$\boldsymbol{ck}$ - buy reference price

$\boldsymbol{cs}$ - sell reference price

co - closing price

cd_1 - co-efficient lowering the price

cu_1 - co-efficient raising the price

n% - loss limiting co-efficient

- the percentage price variation in relation to the previous reference price does not exceed *n%*

$$\boldsymbol{ck = cs = co}$$ **Formula 2-4**

2. The security was not quoted on the date of calculation

$$\boldsymbol{ck = co \times (1 - cd_2)}$$ **Formula 2-5**

$$\boldsymbol{cs = co \times (1 + cu_2)}$$ **Formula 2-6**

where:

cd_2 - co-efficient lowering the price

cu_2 - co-efficient raising the price

co - reference prices based on the last transaction price

KDPW_CCP calculates and distributes the parameter values $n, cd_1, cd_2, cu_1, cu_2$.

3.3 Calculating the margin securing marking to market

Calculating the margin securing marking to market WR_p for portfolio *p* of a clearing member takes place on the basis of the following formula:

$$\boldsymbol{WR_p = -min\left(\sum_i WR_{pi}\,;\,0\right)}$$ **Formula 2-7**

4 TOTAL MARGIN REQUIREMENT

4.1 Calculating the total liquidation risk by portfolio

Total liquidation risk by portfolio is equal to the sum of:

- Margins for final liquidation risk for each liquidity class
- Margins for final liquidation risk for each duration class

$$\boldsymbol{DCLR_p = \sum_k DOLR_{pk}}$$ **Formula 1-16**

where:

$DCLR_p$- total liquidation risk

p - index of the portfolio of a given clearing member

k - class index (liquidity or duration)

Table 2-1 Calculating the portfolio margin

Liquidity/duration class	Final Liquidation Risk
LQPLN1	3 041,43
LQPLN2	927,88
LQPLN3	2 176,00
LQEUR14	1 340,40
DRPPL1	306,55
DRPPL2	2 043,96
DRPPL3	3 933,86
DREPL2	840,00
Portfolio	**14 610,08**

4.2 Calculating the margin requirement by portfolio

Margin requirement for a portfolio is equal to the sum of:

- The margin for total liquidation risk
- The margin for marking to market

$$\boldsymbol{DZP_p = DCLR_p + WR_p} \qquad \textbf{Formula 3-1}$$

where:

DZP_p - margin requirement for portfolio *p*

$DCLR_p$ - *total liquidation risk* for portfolio *p*

WR_p - *marking to market margin*

p - index of the portfolio of a given clearing member

4.3 Calculating the clearing member's total margin requirement

The total margin requirement is equal to the sum of the margin requirements calculated in relation to all portfolios of the clearing member.

$$\boldsymbol{DZU = \sum_p DZP_p} \qquad \textbf{Formula 3-2}$$

where:

DZU - clearing member's total margin requirement

5 GLOSSARY

Total net position
This is calculated at the level of the liquidity or duration class as the difference between the total buy position and total sell position. Positions are calculated using a reference price and a modified duration parameter (for debt securities).

Reference price
The closing price adjusted by any corporate events.

Margin for final liquidation risk
The margin for final liquidation risk is calculated according to the following formulas:
Securities other than debt securities:
Margin for final liquidation risk = margin for intermediary liquidation risk + intra-class spread credit (<0)
Debt securities:
Margin for final liquidation risk = margin for intermediary liquidation risk + intra-class spread credit + inter-class spread credit (<0).

Margin for intermediary liquidation risk
Margin for intermediary liquidation risk is calculated as the sum of the margin for market risk and the margin for specific risk.

Margin for market risk
Securities other than debt securities:
Market risk is the risk of a variation in the price of an instrument within a given liquidity class. The parameter y_k is used to calculate the margin for market risk; this parameter is determined by KDPW_CCP for each liquidity class separately.
Debt securities:
Market risk is the risk of an even shift of the yield curve within a given duration class. The parameter y_k is used to calculate the margin for market risk; this parameter is determined by KDPW_CCP for each duration class separately.

Margin for specific risk
Securities other than debt securities:
Specific risk involves the risk of price variation of a given instrument away from the norm for a given liquidity class as a result of its particular characteristics. The co- efficient x_k is used to calculate the margin to cover specific risk. This co-efficient is determined by KDPW_CCP for each liquidity class separately.
Debt securities:
Specific risk involves the risk of price variation of a given instrument away from the norm for a given duration class as a result of its particular characteristics. The co- efficient x_k is used to calculate the margin to cover specific risk. This co-efficient is determined by KDPW_CCP for each duration class separately.

Margin for intra-class spread
The intra-class spread margin is calculated in order to counter exposure to risk of an uneven shift of the yield curve for a given duration class. The margin is calculated in relation to positions within the spread. This margin is only calculated for debt securities.

Duration class

A set of debt securities with a similar risk profile.

Liquidity class

A series of securities other than debt securities with a similar profile and liquidity.

Inter-class spread credit

Securities other than debt securities:
This is a credit that allows the calculated intermediary liquidation risk to be lowered by recognising a correlation between two different liquidity classes. The credit relates to both classes forming the spread.
Debt securities:
This is a credit that allows the calculated intermediary liquidation risk to be lowered by recognising a correlation between two different duration classes. The credit relates to both classes forming the spread.

Modified duration

The level of sensitivity to price variation of bonds following changes to the interest rate.

Debt securities

Bonds, treasury bonds and mortgage bonds.

Risk parameters

Parameters set by KDPW_CCP to calculate margin parameters.
These include:
- the level of market risk and specific risk (y and x)
- the level of margin for the intra-class spread
- the credit co-efficient for inter-class spread
- co-efficients lowering/increasing the reference price
- co-efficient limiting loss

Cash market portfolio

A set of positions in the clearing cycle (transactions already executed in the stock exchange system, however not yet cleared by KDPW_CCP) differentiated by having the same clearing account identifier.

Inter-class spread

A set of positions in two different classes, so that the total net position in the first class is on the opposite market side to the total net position in the second class.

Intra-class spread

Each set of positions in a single duration class where buy and sell positions may be differentiated.

Total margin requirement

Used to secure potential losses of KDPW_CCP following the close-out of positions of an insolvent KDPW_CCP clearing member. Calculated as the sum of the total liquidation risk for all portfolios of the clearing member and the marking to market margin.

Marking to market

Marking to market is the difference between the value of positions in the clearing cycle revalued to the current market price and the clearing value based on executed transactions.