APPROVED

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CCP NCC METHODOLOGY FOR RISK PARAMETERS OF MOSCOW EXCHANGE DERIVATIVES MARKET

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Contents

I. Introduction

This CCP NCC methodology for risk parameters of the Moscow Exchange Derivatives Market (the "Methodology") sets out

- The procedure for compiling the list of base and minor futures contracts;

- The procedure for calculating auxiliary values used by Moscow Exchange to determine the settlement prices of MOEX futures contracts;

- The procedure for calculating and setting the Upper/Lower Limits of the Price Band for MOEX futures contracts and Upper/Lower Limits of the spread;

- The procedure for calculating Upper/Lower Limits of the market risk assessment range and Upper/Lower Limits of the interest risk assessment range;

- The procedure for building the volatility curves of the MOEX Derivatives Market.

This methodology uses the following acronyms and terms:

Underlying futures contract – a futures contract underlying the option.

Upper/Lower limit of the spread – the value the spread of the Calendar Spread Instrument cannot go above/below, unless the Clearing Rules and/or Trading Rules for the Derivatives Market provide for otherwise.

IM – initial margin.

Group of instruments – a futures contract and an option, if any, with the futures contract being its underlying assets. The futures contract in question is the group's underlying asset.

Calendar spread instrument (spread) – the combination of futures contracts on same Underlying Asset, but different maturities, that is intended to submit the Calendar Spread Order.

Clearing Center – CCP NCC acting on the basis of the clearing license and pursuant to the Clearing Law.

Volatility curve – the curve showing the relationship between volatility and the option strike at a certain price of the Underlying Futures Contract.

Inter-month spread – a combination of futures contracts on the same underlying asset with the correlation in prices between them. The universe of recognised Inter-month Spreads, as well as futures contracts involved in the Inter-month Spread is determined by the Clearing Center.

Inter-contract spread – a combination of futures contracts on different underlying assets with the correlation in prices between them. The universe of recognised Inter-contract Spreads, as well as and futures contracts involved in the Inter-contract Spread is determined by the Clearing Center.

Non-principal futures contract – a futures contract with the 2st level market data priority.

Supporting volatility curve – a volatility curve that might be set as reference for any other volatility curve. A volatility curve for a liquid option series may be used as the Supporting Volatility Curve.

Option – a cash-settled option contract traded on the MOEX Derivatives Market.

Principal futures contract – a futures contract with the 1st level market data priority.

Clearing rules – CCP NCC Clearing Rules.

Trading rules for the Derivatives Market – rules of on-exchange trading in futures and options on the Moscow Exchange Derivatives Market.

Market data priority – a characteristic of the futures contract defined in accordance with Appendix 1 to the Trading Rules for the Derivatives Market.

Clearing Center website – the CCP NCC's official site on the Internet.

Live quote – the current market price of a futures contract determined similar to the settlement price procedure set out in the Settlement Price Methodology for derivatives throughout the trading session upon occurrence of active order book orders and accepted derivatives trades executed based on order book orders. The limits applicable to the settlement price of the futures contract as per clause 9.3 of the Settlement Price Methodology are not applied to the contracts' live quotes.

TS – the MOEX's trading system.

Interest rate futures – a futures contract based on an underlying that pays interest.

Other terms in this paper are used according to their meanings ascribed to them in Russian law, Clearing Rules and other regulations of the Clearing Center as well as Trading Rules for the Derivatives Market.

This methodology uses the following major risk parameters and symbols:

No	Parameter	Symbol
1	Sequence number of the futures contract Sequence numbers are given to contracts on the same underlying asset in accordance with their last trading dates	Num
2	Time interval from the current date to the last trading day of the futures, in a fraction of the year. It is calculated as the number of calendar days in the period divided by 365	$\tau(Num)$
3	The sequence number of the nearest futures involved in the Calendar Spread Instrument	$Num1$
4	The sequence number of the further futures involved in the Calendar Spread Instrument	$Num2$
5	The contract underlying asset	UA
6	The settlement price of the futures with sequence number *Num*. The price is calculated as per the contract specification and the Trading Rules	P(i, Num,UA),
7	The risk center for a futures with sequence number *Num*	RC(i,Num,UA)
8	The settlement price of the underlying contract determined based on the results of the clearing session and converted to match the dimension of the futures	$Spot(i, UA)$
9	The futures contract tick size.	$MinStep(i, Num, UA)$

	Determined in the contract specification	
10	The tick value as determined in the contract specification	$MinStepPrice(i, Num, \mathrm{UA})$
11	Minimum margin rates (in percent), *level*=1,2,3 It is set by the Clearing Center individually for every underlying asset	$MR(UA, level)$
12	Current Minimum margin rates (in percent), *level*=1,2,3	$MRcurr(UA, level)$
13	Interest risk rates in percent per annum. Determined by the Clearing Center for every underlying asset individually for every key point $m = 1, ..., M$	$IR(UA, m)$
14	The number of key points Set by the Clearing Center	M
15	Key terms at key points Determined by the Clearing Center for every underlying asset individually for every key point $m = 1, ..., M$	$T(m)$

Risk parameters 11 and 13-15 are set and updated by the Clearing Center.

II. Procedure for determining auxiliary values used by Moscow Exchange in calculation of settlement prices of futures contracts

1. To determine auxiliary values used by Moscow Exchange in calculation of settlement prices of futures contracts, the Clearing Center uses the following additional risk parameters:

No	Parameter	Symbol
1	Number of the current clearing session (intraday or evening)	i
2	The least number of the principal futures on the underlying asset UA	*NumMin*
3	The greatest number of the principal futures on the underlying asset UA	*NumMax*
4	Futures contract/share/foreign currency/precious metal	Instr
5	Time interval to the date of cash flow j, in a fraction of the year	$\tau(j)$
6	Best bid and best ask prices, and the last trade price for the futures contract/share/foreign	$Bid(date, time, Instr),$ $Ask(date, time, Instr),$

	currency/precious metal that was received as part of MOEX market data at *time* on *date*	$Last(date, time, Instr)$
7	The "Automated Load of Market Data" flag. Valid values are Y and N Set by the Clearing Center for every UA and Num	$MDRule(UA, Num)$
8	Time for loading market data for the clearing session. Set by the Clearing Center for every UA for every clearing session (evening and intraday).	$MDtime(clearing, UA)$
9	Clearing session type: intraday or evening. The valid values are Icl and Ecl	$clearing$
10	Frequency of market data load Set by the Clearing Center for every UA	$freq(UA)$
11	Number of market data loads Set by the Clearing Center for every UA	$count(UA)$
12	Filtered market data intended for settlement in clearing session i	$Bid(i, Instr)$ $Ask(i, Instr)$ $Last(i, Instr)$
13	Parameter determining market data priority Set by the Clearing Center for every UA	$Spread(UA)$
14	Anticipated dividend payments on the share underlying the futures contract Set by the Clearing Center	$CF\big(Fut(j)\big)$
15	The coefficient used to convert values denominated in RUB to settlement price units	$Points(i, UA)$
16	The settlement price of the futures contract determined in clearing session i	P(i, Num, UA)
17	The preliminary settlement price based on market data	$MD(i, Num, UA)$
18	The theoretical price calculated based on market data and changes in prices of liquid futures	$MD\_theor(i, Num, UA)$
19	The preliminary settlement price based on market data subject to anticipated dividend payments	$MD\_dirty(i, Num, UA)$

20	The settlement price of the underlying asset determined based on the results of clearing session i and converted to match the dimension of the futures contract	$Spot(i, UA)$
21	A set of interest curve rates in percent per annum (the interest rate curve). Set by the Clearing Center for every UA individually at every key point m	$r(i, m, UA)$
22	Flag for automatic loading of market data. The valid values "Y" and "N". It is set by the Clearing Center for every UA and Num	$MDRule(UA, Num)$

2. If MDRule(UA,Num) is set to N, then, at moment MDtime(clearing,UA), values Bid(date,time,Instr), Ask(date,time,Instr) and Last(date,time,Instr) for instrument Instr(UA) are determined based on quotes of analogous instruments loaded from the information system (Bloomberg and/or Reuters).

3. Theoretical settlement prices $MD\_theor(i, Num, UA)$ are determined for all non-principal futures according to the algorithm set out in paragraphs 3-6 of this Section.

4. If principal futures on underlying asset UA exist, the following algorithm is applied to determine theoretical prices $MD\_theor(i, Num, UA)$ of non-principal futures:

   4.1. $MD\_theor(i, Num, UA)$ are calculated for every Num<NumMin:

      4.1.1. For futures other than the interest rate futures

$$MD\_theor(i, Num, UA) = P\_dirty(i - 1, Num, UA) * \frac{MD\_dirty(i, NumMin, UA)}{P\_dirty(i - 1, NumMin, UA)}$$

      4.1.2. For futures (other than the interest rate futures) on underlying assets such as a share, foreign currency or precious metal for which market data from the MOEX Equity & Bond, Deposit, FX and Precious Metals Markets is not available:

$$MD\_theor(i, 0, UA) = MD\_dirty(i, NumMin, UA) \cdot e^{-r(i-1,\tau(NumMin)) \cdot \tau(NumMin)}$$

      4.1.3. For interest rate futures contracts:

$$MD\_theor(i, 0, UA))$$
$$= MD\_theor(i, NumMin, UA) - r(\tau(NumMin), UA) \cdot \tau(NumMin)$$

   4.2.   For every Num>NumMax, $MD\_theor(i, Num, UA)$ is calculated as follows:

      4.2.1. For futures other than the interest rate futures

$$MD\_theor(i, Num, UA) =$$
$$= P\_dirty(i - 1, Num, UA) * \frac{MD\_dirty(iNumMax, UA)}{P\_dirty(i - 1, NumMax, UA)}$$

4.2.2. For the interest rate futures

$$MD\_theor(i, Num, UA)$$
$$= P\_dirty(i - 1, Num, UA) + (MD\_dirty(iNumMax, UA)$$
$$- P\_dirty(i - 1, NumMax, UA))$$

4.3. For every non-principal futures, for which NumMin<Num<NumMax, $MD\_theor(i, Num, UA)$ is calculated as the average of:

4.3.1. For futures other than the interest rate futures

i. $P\_left(i, Num, UA) = P\_dirty(i - 1, Num, UA) *$

$\frac{MD\_dirty(i, left, UA)}{P\_dirty(i - 1, left, UA)}$,

where $left$ – the nearest left Num of the principal futures.

ii. $P\_right(i, Num, UA) = P\_dirty(i - 1, Num, UA) *$

$\frac{MD\_dirty(i, right, UA)}{P\_dirty(i - 1, right, UA)}$,

where $right$ - the nearest right Num of the principal futures.

4.3.2. For the interest rate futures

iii. $P\_left(i, Num, UA) = P\_dirty(i - 1, Num, UA) +$
$(MD\_dirty(i, left, UA) - P\_dirty(i - 1, left, UA))$,

where $left$ – the nearest left Num with priority 1.

iv. $P\_right(i, Num, UA) = P\_dirty(i - 1, Num, UA) +$
$(MD\_dirty(i, right, UA) - P\_dirty(i - 1, right, UA))$,

where $right$ – the nearest right Num of the principal futures.

5. If all futures on underlying asset UA are non-principal, theoretical settlement prices $MD\_theor(i, Num, UA)$ are set equal to the previous values of settlement prices $P\_dirty(i - 1, Num, UA)$. If market data from the MOEX Equity & Bond, Deposit, FX and Precious Metals Markets is not available for the underlying asset, $MD\_theor(i, 0, UA)$ is set equal to Spot (i-1, UA).

6. The theoretical settlement prices for non-principal futures on underlying asset UA are adjusted for market data by the following algorithm:

6.1. The "dirty" values of non-zero $Bid\_dirty(i, Instr)$ and $Ask\_dirty(i, Instr)$ are calculated by using $Bid(i, Instr)$ and $Ask(i, Instr)$:

6.1.1. The "dirty" values of market data for futures other than the interest rate futures:

$$MD_{dirty(i, Num, UA)} = MD(i, Num, UA) + Points(i, UA) *$$

$$e^{r(i-1, \tau(Num), UA) \cdot \tau(Num)} * \sum_{j=1}^{j \leq Num} \left[CF(Fut(j)) * e^{-r(i-1, \tau(j), UA) * \tau(j)} \right],$$

where

$\tau(Num)$ – the time interval to the exercise of the futures with number Num ($\tau(0) = 0$);

$r(i-1, \tau, UA)$ – the rate applied to interval τ, calculated in the previous clearing session (i-1),

$Points$ – the coefficient for converting RUB to the settlement price unit. Calculated as per the following formula:

$$Points(i, UA) = \left. MinStep(i, 1, UA) \middle/ MinStepPrice(i, 1, UA) \right.$$

6.1.2. Market data is converted as follows for the interest rate futures:

    6.1.2.1. With prices in indirect quotes:

$$MD\_dirty(i, Num, UA) = 1 - MD(i, Num, UA)/100$$

    6.1.2.2. With prices in direct quotes:

$$MD\_dirty(i, Num, UA) = MD(i, Num, UA)/100$$

6.2. If both $Bid\_dirty(i, Instr)$ and $Ask\_dirty(i, Instr)$ are available,

$$MD\_theor(i, Num, UA)$$
$$= mid[Ask\_dirty(i, Instr); MD\_theor(i, Num, UA); Bid\_dirty(i, Instr)].$$

$mid[\,]$ – the function returning the median value of a given set of variables.

6.3. If only $Bid\_dirty(i, Instr)$ is available,

$$MD\_theor(i, Num, UA) = max[MD\_theor(i, Num, UA); Bid\_dirty(i, Instr)].$$

6.4. If only $Ask\_dirty(i, Instr)$ is available,

$$MD\_theor(i, Num, UA) = min[MD\_theor(i, Num, UA); Ask\_dirty(i, Instr)].$$

7. The algorithm applied to determine $P\_dirty(i, Num, UA)$ (the dirty settlement price determined in the clearing session i) based on interest rate curve $r(i, m, UA)$ and theoretical settlement prices $MD\_theor(i, Num, UA)$:

7.1. For every futures contract:

    7.1.1. $r(i, \tau(Num), UA)$ is obtained through linear interpolation;

    7.1.2. Auxiliary value Spot(Num) is determined as follows:

        7.1.2.1. For futures other than the interest rate futures

$$Spot(Num) = MD\_theor(i, Num, UA) * \exp(-r(i, \tau(Num), UA) * \tau(Num))$$

        7.1.2.2. For interest rate futures:

$$Spot(i, Num) = MD\_theor(i, Num, UA) - r(i, \tau(Num), UA)$$

7.2. $P\_dirty(i, Num, UA)$ is calculated for every principal futures according to the MOEX Trading Rules for the Derivatives Market. The theoretical price of the

principal futures is calculated as follows $MD\_theor(i, Num, UA) = P\_dirty(i, Num, UA)$.

7.3. The algorithm for calculating $P\_dirty(i, 0, UA)$ for all non-principal futures is as follows:

7.3.1. If Num=0, $P\_dirty(i, 0, UA)$ equals:

7.3.1.1. The average of $Spot(Num)$, if principal futures on underlying asset UA is available.

7.3.1.2. $P\_dirty(i - 1, 0, UA)$, if principal futures on underlying asset UA is not available.

7.3.2. The algorithm for determining $P\_dirty(i, Num, UA)$ for Num>0:

7.3.2.1. For futures other than the interest rate futures

$$P\_dirty(i, Num, UA)$$
$$= P\_dirty(i, 0, UA) * \exp(r(i, \tau(Num), UA) * \tau(Num)$$

7.3.2.2. For the interest rate futures

$$P\_dirty(i, Num, UA) = P\_dirty(i, 0, UA) + r(i, \tau(Num), UA)$$

7.3.3. P_dirty is adjusted for market data according to the algorithm set out in clause 5 of this Section, with MD_theor replaced by P_dirty.

7.3.4. If market data derived from the MOEX Equity & Bond Market, Deposit, FX and Precious Metals Markets is not available for the underlying share, currency or precious metal, $Spot(i, UA)$ is set equal to $P\_dirty(i, 0, UA)$.

III. How market and interest rate risks assessment ranges, price band for futures and spread limits are determined

I. How market and interest rate risks assessment ranges, price band for futures and spread band are determined in the clearing session

1. To determine the Upper/Lower Limits of the market risk assessment range, Upper/Lower Limits of the interest rate risk assessment range, Upper/Lower Limits of the Price Band for futures as well as Upper/Lower Limits of the spread in the clearing session, the following risk parameters are also used:

No	Parameter	Symbol
1	The notional value of the interest rate futures according to the contract specification	$N(UA)$
2	IM decrease velocity on the interest rate futures. Set by the Clearing Center	$\alpha(UA)$
3	The end of the IM decrease on the interest rate futures. Set by the Clearing Center as a fraction of	$T\_min(UA)$

	the year. It is calculated as the number of the calendar days of decrease divided by 365.	
4	The beginning of the IM decrease on the interest rate futures. Set by the Clearing Center as a fraction of the year. It is calculated as the number of the calendar days of decrease divided by 365.	$T\_max(UA)$
5	The tick according to the contract specification	$MinStep(i, Num, UA)$
6	The tick value according to the contract specification	$MinStepPrice(i, Num, UA)$
7	The width (in a unit fraction) of the price band. Set by the Clearing Center for every underlying asset and every Num	$RangeFut(Num, UA)$
8	The width (in a unit fraction) of the spread. Set by the Clearing Center for every Calendar Spread Instrument involving futures $Num1$ and $Num2$	$RangeCS(Num1,$ $Num2, UA)$
9	Current risk rates (in percent per annum) of interest rates rising. Calculated for every futures Num	$IRcurr(UA, Num, u)$
10	Current risk rates (in percent per annum) of interest rates decreasing. Calculated for every futures Num	$IRcurr(UA, Num, d)$
11	Upper limit of the market risk assessment range	$RightRiskboundMR(Num, UA, level)$
12	Lower limit of the market risk assessment range	$LeftRiskboundMR(Num, UA, level)$
13	Upper limit of the interest rate risk assessment range	$RightRiskboundIR(Num, UA)$
14	Lower limit of the interest rate risk assessment range	$LeftRiskboundIR(Num, UA)$

Risk parameters No.2-4, 7 and 8 are set by the Clearing Center.

2. In the clearing session, the Upper (Lower) limit of the Price Band is calculated by the following algorithm:

2.1. All futures contracts:

$RC(i, Num, UA) = P(i, Num, UA),$

$MRcurr(UA, level) = MR(UA, level)$

$IRcurr(UA, Num, u) = IRcurr(UA, Num, d) = interp(IR(UA, m), \tau(Num)) ,$

where $interp(IR(UA, m), \tau(Num))$ - the interest rate discrepancy risk rate interpolated according to the following formulae:

$$interp(IR(UA, m), \tau(Num)) = \frac{(IR(UA, R) - IR(UA, L))(\tau(Num) - T(L))}{T(R) - T(L)} + IR(UA, R)$$

If $\tau(Num) > Tmax$

$$interp(IR(UA, m), \tau(Num)) = IR(UA, T(\max))$$

where

T – the time left to settlement of the futures, in days,

$T(R), T(L)$ – key points nearest to term T, $T(R) > T(L)$,

R, L – numbers of the key points,

$T(max)$ – maximum key term.

2.2. Auxiliary value *IM(UA,Num)* of the IM decrease velocity is calculated for the interest rate futures:

$$IM(UA, Num) = N(UA) \cdot \left(\left(T_{max}(UA) - T_{min}(UA) \right) \cdot \varphi^\alpha + T_{min}(UA) \right) \cdot \frac{MinStep(i,Num,UA)}{MinStepPrice(i,Num,UA)},$$

where

$$\varphi = \min(\max\left(\frac{\tau(Num) - T_{min}(UA)}{T_{max}(UA) - T_{min}(UA)} ; 0 \right); 1),$$

N(UA) – the contract notional value,

$\alpha(UA)$ – IM decrease velocity, the parameter of the underlying asset,

$T\_min(UA), T\_max(UA)$ - the parameters of the underlying asset: the time left to expiry.

2.3. The following auxiliary value is calculated for every futures Num:

2.3.1.   All futures other than the interest rate futures:

$$RiskRange(i, Num, UA) = [RC(i, Num, UA) + Spot(i, UA) \cdot MRcurr(UA, 1)] \cdot e^{IRcurr(UA,Num,u) \cdot \tau(Num)} - \tag{2}$$

$$-[RC(i, Num, UA) - Spot(i, UA) \cdot MRcurr(UA, 1)] \cdot e^{-IRcurr(UA,Num,d) \cdot \tau(Num)}$$

2.3.2.   The interest rate futures:

$$RiskRange(i, Num, UA) = [RC(i, Num, UA) + MRcurr(UA, 1) \cdot IM(UA, Num) + IRcurr(UA, Num, u)] - \tag{3}$$

$$-[RC(i, Num, UA) - MRcurr(UA, 1) \cdot IM(UA, Num) - IRcurr(UA, Num, d)]$$

2.4. The Upper/Lower limit of the Price Band for futures *Num* is calculated as follows:

$$HboundFut(Num, UA) =$$

$$P(i, Num, UA) + \frac{1}{2} * RangeFut(Num, UA) * RiskRange(i, Num, UA) \tag{4}$$

$$LboundFut(Num, UA) =$$

$$P(i, Num, UA) - \frac{1}{2} * RangeFut(Num, UA) * RiskRange(i, Num, UA) \quad (5)$$

2.5. Auxiliary value $PriceRangeFut(i, Num, UA)$ is calculated which is a half-width of the Price Band for futures Num calculated in clearing session i:

$$PriceRangeFut(i, Num, UA) =$$

$$\frac{1}{2} * RangeFut(Num, UA) \cdot RiskRange(i, Num, UA) \quad (6)$$

3.   The Upper/Lower Limit of spread Num1/Num2 is calculated according to the following algorithm if conditions set out in clause 4 below are not met:

3.1. The following auxiliary value is calculated:

3.1.1. All futures other than the interest rate futures:

$$RiskRangeCS(Num1, Num2, UA) \quad = [P(i, Num2, UA)] \cdot \qquad\qquad (7)$$
$$\cdot \left[e^{IRcurr(UA, Num2, u) \cdot \tau(Num2)} \right.$$
$$\left. - e^{-IRcurr(UA, Num2, d) \cdot \tau(Num2)} \right]$$

3.1.2. The interest rate futures:

$$RiskRangeCS(Num1, Num2, UA) = \qquad IRcurr(UA, Num2, u) + \qquad\qquad (8)$$
$$+ IRcurr(UA, Num2, d)$$

3.2. The Upper/Lower Limit of the spread is calculated as follows:

$$HboundCS(Num1, Num2, UA) = \qquad P(Num1, Num2, UA) \qquad\qquad (9)$$
$$+ \frac{1}{2} RangeCS(Num1, Num2, UA) \cdot$$
$$\cdot RiskRangeCS(Num1, Num2, UA)$$

$$LboundCS(Num1, Num2, UA) = \qquad \begin{aligned} &P(Num1, Num2, UA) - \\ &- \frac{1}{2} RangeCS(Num1, Num2, UA) \\ &\qquad \cdot RiskRangeCS(Num1, Num2, UA) \end{aligned} \qquad (10)$$

where

$$P(Num1, Num2, UA) = \qquad P(i, Num2, UA) - P(i, Num1, UA) \qquad (11)$$

3.3. Auxiliary value $PriceRangeCS(i, Num1, Num2, UA)$ is calculated which is a half-width of the Upper/Lower Limit of spread Num1/Num2 calculated in clearing session i:

$$PriceRangeCS(i, Num1, Num2, UA) \quad = \frac{1}{2} RangeCS(Num1, Num2, UA) \cdot \qquad (12)$$
$$\cdot RiskRangeCS(Num1, Num2, UA)$$

4.   If just two or less clearing sessions are there to settlement of futures Num1 and the futures is not in the Inter-month Spread, the Upper/Lower Limit of spread Num1/Num2 is calculated by the following algorithm:

4.1. The Upper/Lower Limit of the spread is calculated as follows:

$$HboundCS(Num1, Num2, UA)$$

$$= P(Num1, Num2, UA) + \frac{1}{2} * RangeFut(Num2, UA)$$

$$* RiskRange(i, Num2, UA)$$

$$LboundCS(Num1, Num2, UA)$$

$$= P(Num1, Num2, UA) - \frac{1}{2} * RangeFut(Num2, UA)$$

$$* RiskRange(i, Num2, UA)$$

$$P(Num1, Num2, UA) = P(i, Num2, UA) - P(i, Num1, UA)$$

5. The limits of the market risk assessment range are calculated as follows:

5.1. The Upper Limit:

5.1.1. All futures other than the interest rate futures:

$$RightRiskboundMR(Num, \text{UA}, level)$$
$$= RC + MRcurr(\text{UA}, level) \cdot abs(Spot(\text{UA}))$$

(13)

5.1.2. The interest rate futures

$$RightRiskboundMR(Num, \text{UA}, level)$$
$$= RC + MRcurr(\text{UA}, level) \cdot IM(\text{UA}, Num)$$

(14)

5.2. The Lower Limit:

5.2.1. All futures other than the interest rate futures:

$$LeftRiskboundMR(Num, \text{UA}, level)$$
$$= RC - MRcurr(\text{UA}, level) \cdot abs(Spot(\text{UA}))$$

(15)

5.2.2. The interest rate futures

$$LefttRiskboundMR(Num, \text{UA}, level)$$
$$= RC - MRcurr(\text{UA}, level) \cdot IM(\text{UA}, Num)$$

(16)

6. The limits of the interest rate assessment range are calculated as follows:

6.1.The Upper Limit:

$$RightRiskboundIR(Num, \text{UA}) = IRcurr(\text{UA}, Num, u)$$

(17)

6.2. The Lower Limit:

$$LeftRiskboundIR(Num, \text{UA}) = -IRcurr(\text{UA}, Num, d)$$

(18)

II. The monitoring and amendment of assessment range limits for market and interest rate risks, price band limits for futures contracts and spread limits during the Settlement Period

1.   The following auxiliary risk parameters are used to monitor adequacy and changes of the risk parameters during the Settlement Period:

No	Parameter	Symbol
1	The time used to monitor adequacy of the Upper/Lower Limit of the Price Band (in minutes) in respect of the futures during the Settlement Period. It is set by the Clearing Center for every underlying asset.	$FutMonTime(UA)$
2	The width of the monitoring range (in fractions). It is used to monitor adequacy of the Upper/Lower Limit of the Price Band. It is set by the Clearing Center for every underlying asset.	$FutMonRange(UA)$
4	The maximum number of changes in the limits of the Price Band during the Settlement Period. It is set by the Clearing Center for every underlying asset.	$AutoShiftNumMR(UA)$
5	The maximum number of changes in the limits of the interest risk assessment range during the Settlement Period. It is set by the Clearing Center for every underlying asset.	$AutoShiftNumIR(UA)$
6	The shift size for the futures price band. It is set by the Clearing Center for every underlying asset.	$FutShift(UA)$
7	The maximum sequence number of the futures at which the Upper/Lower Limits of the Price Band are supposed to be changed if there is an order on the contract with the price at the Upper/Lower Limit of the Price Band. It is set by the Clearing Center for every underlying asset.	$FutMonNum(UA)$
8	The time (in minutes) used to monitor adequacy of the Upper/Lower Limit of the spread during the Settlement Period. It is set by the Clearing Center for every underlying asset.	$CSMonTime(UA)$
9	The width of the monitoring corridor for the Calendar Spread Instruments. It is set by the Clearing Center for every underlying asset.	$CSMonRange(UA)$
10	The maximum sequence number of the far futures involved in the Calendar Spread Instrument at which the Upper/Lower Limit of the spread is supposed to be changed if there has been a shift away from that number.	$CSMonNum(UA)$

	It is set by the Clearing Center for every underlying asset.	
11	The shift in the Upper/Lower Limit of the spread. It is set by the Clearing Center for every underlying asset.+	$CSShift(UA)$

2. The Clearing Center changes the Upper/Lower Limit of the market risk assessment range for futures Num during the Settlement Period if the following conditions are met at the same time:

    a. At least one anonymous Active Bid/Ask for the futures is available in the Trading System continuously for $FutMonTime$ since its acceptance, and its price differs from the Upper/Lower Limit of the Price Band by no more than threshold $FutMonRange(UA) \cdot PriceRangeFut(i, Num, UA)$.

    b. The number of shifts in the Upper/Lower Limits of the market risk assessment range during the Settlement Period is no more than $AutoShiftNumMR(UA)$.

    c. Futures number Num is not greater than $FutMonNum\ (UA)$.

3. During the Settlement Period, the Clearing Center changes the Upper/Lower Limits of the interest risk assessment range if the following conditions are met at the same time (save for cases set out in paragraph 8 of this Section):

    a. An active bid/ for the Calendar Spread Instrument Num1/Num2 is available at less than $CSMonRange(UA) * PriceRangeCS(i, Num1, Num2, UA)$ away from the Upper/Lower Limit of the spread for at least $CSMonTime$ sec.

    b. During the trading session, the number of shifts in the Upper/Lower Limits of the interest risk assessment range for the underlying asset is not greater than $AutoShiftNumIR(UA)$.

    c. Num2 is not greater than $CSMonNum(UA)$.

4. If conditions set out in paragraph 2 or 3 above are true in respect of the futures during the Settlement Period, the Clearing Center sends a notice to the Exchange asking to suspend trading in the futures, all futures on the same underlying asset regulated by the same Specification, all futures involved in an Inter-contract Spread alongside the futures as well as all options on any of the futures specified above in this paragraph, for a period of maximum 15 (fifteen) minutes.

5. After the limits of the market risk assessment range in respect of a futures contract, or the limits of the interest risk assessment range are changed, the Clearing Center notifies the Exchange of the trading suspension lifted via the Trading System.

6. If the Upper/Lower Limit of the market risk assessment range for the futures contracts is going to be shifted, the following values are calculated:

6.1. The current value of the market risk rates is recalculated:

$$MRcurr(UA, level) = MRcurr(UA, level) + 0.5 \cdot FutShift(UA) \cdot MR(UA, 1) \quad (19)$$

6.2. The risk center is determined as follows:

1. If the Upper Limit of the market risk assessment range is shifted:

   a. All futures other than the interest rate futures:

$$RC(Num, UA, new) = RC(Num, UA, old) + 0.5 FutShift(UA) \cdot MR(UA, 1) \quad (20)$$
$$\cdot Spot(i, UA)$$

   b. The interest rate futures:

$$RC(Num, UA, new) = RC(Num, UA, old) + 0.5 \cdot FutShift(UA) \cdot MR(UA, 1) \quad (21)$$
$$\cdot IM(UA, Num)$$

2. If the Lower Limit of the market risk assessment range is shifted:

   a. All futures other than the interest rate futures:

$$RC(Num, UA, new) = RC(Num, UA, old) - 0.5 \cdot FutShift(UA) \cdot MR(UA, 1) \quad (22)$$
$$\cdot Spot(i, UA)$$

   b. The interest rate futures:

$$RC(Num, UA, new) = RC(Num, UA, old) - 0.5 \cdot FutShift(UA) \cdot MR(UA, 1) \quad (23)$$
$$\cdot IM(UA, Num)$$

6.3. Ancillary value $RiskRange(Num, UA, new)$ is calculated for every futures Num in a way similar to that specified in paragraph 2.4.2, Section I above.

6.4. Ancillary value $DeltaRangeFut(Num, UA)$ is calculated as follows:

$$DeltaRangeFut(Num, UA) = RiskRange(Num, UA, new) \quad (24)$$
$$- RiskRange(old, Num, UA)$$

where $RiskRange(old, Num, UA)$ - the value calculated before the Price Band was changed.

6.5. The Upper/Lower Limits of the Price Band are recalculated as follows:

$$HboundFut(Num, UA, new) = HboundFut(old, Num, UA) \quad (25)$$
$$+ DeltaRangeFut(Num, UA)$$

$$LboundFut(Num, UA, new) = \quad (26)$$
$$LboundFut(old, Num, UA)$$
$$- DeltaRangeFut(Num, UA)$$

7. If the Upper/Lower Limit of the spread is shifted, the following values are calculated:

7.1. If the Upper Limit is changed:

    7.1.1. The current interest rate downside risk rate is recalculated:

$$IRcurr(UA, Num2, u) \qquad (27)$$
$$= IRcurr(UA, Num2, u, old) + CSShift(UA)$$
$$* IR(UA, Num2)$$

where

$IRcurr(UA, Num2, u, old)$ – the current interest rate downside risk rate calculated last.

7.2. If the Lower Limit is changed

    7.2.1. The current interest rate upside risk rate is recalculated:

$$IRcurr(UA, Num2, d) \qquad (28)$$
$$= IRcurr(UA, Num2, d, old) + CSShift(UA)$$
$$* IR(UA, Num2)$$

where

$IRcurr(UA, Num2, d, old)$ – the current interest rate downside risk rate calculated last time.

    7.2.2. Ancillary value $RiskRangeCS(Num1, Num2, UA)$ is calculated for every futures Num in a way similar to that specified in paragraph 3.1.2 of Section I above.

    7.2.3. Additional value $DeltaRangeCS(Num1, Num2, UA)$ is calculated:

$$DeltaRangeCS(Num1, Num2, UA) \qquad (29)$$
$$= RiskRangeCS(Num1, Num2, UA)$$
$$- RiskRangeCS(Num1, Num2, UA, old)$$

$RiskRangeCS(Num1, Num2, UA, old)$ $\qquad$ – $\qquad$ additional $\qquad$ value $RiskRangeCS(Num1, Num2, UA)$ calculated last time in the TS.

7.3. Then, the Upper/Lower Limits of the spread are recalculated as follows:

$$HboundCS(Num1, Num2, UA, new) \qquad (30)$$
$$= HboundCS(Num1, Num2, UA, old)$$
$$+ DeltaRangeCS(Num1, Num2, UA)$$

    or

$$LboundCS(Num1, Num2, UA, new) \quad\quad (31)$$
$$= LboundCS(Num1, Num2, UA, old)$$
$$- DeltaRangeCS(Num1, Num2, UA)$$

8.   If two or fewer clearing sessions to go until futures Num1 is settled and the futures is not in the Inter-Month Spread, adequacy of the Upper/Lower Limit of spread Num1/Num2 is not monitored.

    8.1. The price band limits for a calendar spread are changed if $MRcurr(UA, level)$ has been changed. In this case, the Upper/Lower Limits of the spread are recalculated according to the formulas given in paragraph 4, Section II, Part 3 above.

9.   The Upper/Lower Limits of the market risk assessment range and Upper/Lower Limits of the interest risk assessment range are calculated according to paragraphs 4-6 of Section I of this Part.

III.   Miscellaneous

1.   The Upper/Lower Limit of the market risk assessment range or Upper/Lower Limit of the interest risk assessment range may also be changed by the Clearing Center's decision adopted in the course of the clearing session or at any time out of the clearing session or the Settlement Period unless the Clearing Rules provide for otherwise.

2.   If the Upper/Lower Limit of the market risk assessment range or Upper/Lower Limit of the interest risk assessment range is needed to be changed, values of rates $MRcurr(UA, level)$, $IR(UA, m)$, $IRcurr(UA, Num, u)$, $IRcurr(UA, Num, d)$ are set by the Clearing Center.

3.   If conditions set out in paragraph 1 of this Section are true in respect of the futures throughout the Settlement Period, the Clearing Center sends a notice to the Exchange asking to suspend trading in the futures, all futures on the same underlying asset regulated by the same Specification, all futures involved in an Inter-contract Spread alongside the futures as well as all options on any of the futures specified above in this paragraph, for a period of maximum 15 (fifteen) minutes.

4.   To initiate the suspension of trading, the Clearing Center sends the relevant notice to the Exchange via the TS.

5.   If the Upper/Lower Limit of the market risk assessment range or Upper/Lower Limit of the interest risk assessment range is changed according to paragraph 1 of this Section, the Clearing Center notifies clearing members of the change in the Upper/Lower Limit of the Price Band for the futures and Upper/Lower Limit of the market risk assessment range or Upper/Lower Limit of the spread for the futures and Upper/Lower Limit of the interest risk assessment range by posting the relevant information on its website and/or sending

the notices via the TS no later than 15 minutes before the new value of the Upper/Lower Limit of the market risk assessment range or Upper/Lower Limit of the interest risk assessment range starts to be applied.

IV.   Initial margin parameters

The Clearing Center sets the following risk parameters for the calculation of initial margins:

No	Parameter	Symbol
1	Concentration limit, 1st and 2nd levels. It is set by the Clearing Center for every underlying asset.	*LK1, LK2*
2	The upside/downside risk rate to implied volatility. It is set by the Clearing Center for every underlying asset.	*VR(UA)*
3	The implied volatility divergence risk rate. It is set by the Clearing Center for every underlying asset.	*VVR(UA)*
4	The number of volatility curves. It is set by the Clearing Center.	*VolatNum*
5	The number of Settlement Periods in which expiry scenarios are considered in calculation of initial margin for positions run under the Settlement Code.	*ExpClearingSA*
6	The premium for fluctuations in the foreign currency in which the tick for the Group of Instruments is denominated. It is set by the Clearing Center.	*R*
7	The list of Inter-month Spreads and involved futures contracts. It is set by the Clearing Center.	-
8	The list of Inter-contracts Spreads and involved futures contracts. It is set by the Clearing Center.	-

The risk parameters' values are posted on the Clearing Center's website.

V. Calculation of volatility curves

A volatility curve (implied volatility curve) is calculated by the Clearing Center for call and put options with the same underlying asset and same expiry date (within the same option series).

Volatility curves are calculated automatically in accordance with this Methodology. The Clearing Center may set other values of volatility curve coefficients.

I.   Calculation algorithm

1.   A volatility curve is calculated as follows:

     1.   Prices of the best bids and asks for call and put options are determined on accordance with Section II above;
     2.   The volatility curve parameters needed to be adjusted are determined (depending on the curve locking);
     3.   The volatility curve is calculated in accordance with Section III of this Part;
     4.   The volatility curve coefficients are adjusted in accordance with Sections IV-VI of this Part.

2.   The automatic calculation of curves is stopped ten minutes before the start of the evening and/or intraday clearing sessions.

II.   Best bids and asks for call and put options

1.   The input data for constructing the volatility curve is:

- prices of Active anonymous buy and sell orders per every option series, number of Derivatives Contracts in active bids and asks as well as the time during which every order is displayed continuously as the active order in the Trading System;

- T – the time period (in a fraction of the year) from the curve calculation point to the last trading day for the options;

- F – the Live Quote for the Underlying Futures at the moment of the curve construction.

The universe includes active anonymous orders with the size of over V_{min} and the time in the TS of over T_{min}. Parameters V_{min} and T_{min} are set by the Clearing Center.

2.   Active anonymous best bids and asks are selected for every option. If such bids or asks are not available for a certain option series, the best price is considered not existing.

3.   The Active anonymous best bids and asks are recalculated to implied volatility. The Black model for futures-style options on futures is used:

$$C = F \cdot N(d_1) - Strike \cdot N(d_2)$$

$$P = C - F + Strike,$$

where C, P – the price of the call and put options, respectively,

$$d_1 = \frac{\ln\left(\frac{F}{Strike}\right) + 0.5\sigma^2 T}{\sigma\sqrt{T}} \qquad d_2 = \frac{\ln\left(\frac{F}{Strike}\right) - 0.5\sigma^2 T}{\sigma\sqrt{T}}$$

$$N(x) = \frac{1}{\sqrt{2\pi}} \int_{-\infty}^{x} e^{-\frac{y^2}{2}} \, dy - \text{the standard normal distribution.}$$

σ – implied volatility in a fraction of one.

Implied volatility σ is determined at C or P by using a numerical method. It is multiplied by 100 for further calculations. If best bid of ask is not available for a certain strike, the relevant implied volatility is set to zero.

Therefore, there are four prices for every strike: call_bid, call_ask, put_bid and put_ask.

4.   The bid and ask are calculated for every strike:

3.1. Auxiliary variables max_bid and min_ask are calculated:

$$max\_bid = \begin{cases} \max(put\_bid, call\_bid)\text{, if both orders are available,} \\ \text{the bid price, if only one order is available,} \\ 0 - \text{ otherwise} \end{cases}$$

$$min\_ask = \begin{cases} \min(put\_ask, call\_ask)\text{, if both orders are available,} \\ \text{the ask price, if only one order is available,} \\ 0 - \text{ otherwise} \end{cases}$$

3.2. The bid and ask are calculated:

$$bid = \begin{cases} \min(max\_bid, min\_ask)\text{, if } max\_bid \neq 0 \text{ and } min\_ask \neq 0, \\ max\_bid\text{, if } max\_bid > 0 \text{ and } min\_ask = 0 \\ 0 - \text{ otherwise} \end{cases}$$

$$ask = \begin{cases} \max(max\_bid, min\_ask)\text{, if } max\_bid \neq 0 \text{ and } min\_ask \neq 0, \\ min\_ask\text{, if } min\_ask > 0 \text{ and } max\_bid = 0, \\ 0 - \text{ otherwise} \end{cases}$$

Notes. If call_bid > put_ask or put_bid > call_ask (intervals (call_bid, call_ask) and (put_bid, put_ask) do not cross), interval bid – ask will be determined as the gap between the intervals mentioned above, i.e. (put_ask, call_bid) шт the first instance and (call_ask, put_bid) on the second instance.

III.   Calculation of the volatility curve

1.   The volatility curve is calculated according to the following formula:

$$\sigma = f(x, s, a, b, c, d, e) = a + b \cdot (1 - \exp(-cy^2)) + \frac{d \cdot arctg(e \cdot y)}{e},$$

where

s, a, b, c, d, e – the parameters needed to be adjusted; hereinbelow, the parameters are denoted param(1), param(2),…, param(6), respectively, or param(1÷6) in short;

$x = \frac{1}{\sqrt{T}} \ln \left(\frac{Strike}{F} \right)$ – x-coordinate of the curve;

$y = x - \frac{s}{\sqrt{T}}.$

2.	If a Supporting Volatility Curve has not been determined for the given volatility curve, the parameters are given their most recent values at the start of the adjusting process.

3.	If a Supporting Volatility Curve has been determined for the given volatility curve, the parameters are given values of the supporting curve parameters at the start of the adjusting process.

4.	After the end of the evening trading session on the last trading day for the options, theoretical value of the options are determined based on parameters of curve param(1÷6)=(0,0,0,1,0,1) in accordance with the Methodology for calculating option theoretical value and delta.

## IV.	Volatility curve adjustment

1.	The curve is constructed by minimizing criterion function Cr.

2.	The criterion function is the sum of error exponents at strikes. The errors are weighted by their remoteness from the central strike by using a descending function.

3.	 The curve parameters are adjusted in two stages:

   1.	Rough adjustment – the pseudorandom variation method;
   2.	Fine adjustment – a coordinate descent algorithm.

4.	Rough adjustment

   4.1. The method implies a shift of current parameters by $\xi \cdot 100$ percent,
   where ξ is a six-dimensional quasi-random number evenly distributed in cube $[-1.5;1.5]$ that is derived from the quasi-random 6×16383 Sobol sequence (numbers evenly distributed in [0, 1]).

   If an iteration in the rough adjustment process results in a decrease of the criterion function, option prices are tested for the monotonicity condition according to Section V below.

   If option prices are monotonic according to Section V below, values derived as a result of that iteration are accepted.

5.	Fine adjustment

   5.1.	The coordinate descent algorithm is used in rough adjustment. One cycle of rough adjustment implies improving all six coordinates in sequence.

   5.2.	One coordinate is improved according to the following algorithm:
   1.	The initial step is chosen: $Step = Step_0$,
   2.	The criterion function is determined at a parameter shift up and down by Step. The lowest value of the function and the shift direction are chosen,
   3.	If the shift by Step in that direction results in a decrease of the criterion function, the options prices are tested for the monotonicity condition,

4. If the prices are monotonic, the algorithm goes back to item 2 above,

5. If the prices are not monotonic or the criterion function has not decreased, step Step is halved and the algorithm goes back to item 2,

6. The cycle is repeated until $Step > 0.0001 \cdot Step_0$.

V. Testing for monotonicity of volatility curve

1. Volatility curves are tested for two different monotonicity types for every option series according to paragraphs 2 and 3 of this Section.

2. A test is run to find out whether the prices of call options are not increasing, and the price of put options are not decreasing, for the strike. If the volatility curve is found to be non-monotonic, its parameters are given their most recent values.

3. Call and put options prices are differentiated with respect to the strike price across all strikes

$$\frac{\partial C}{\partial Strike} = N'(d_2) \cdot \frac{\partial \sigma}{\partial y} - N(d_2)$$

$N'(x) = \frac{1}{\sqrt{2\pi}} e^{-\frac{x^2}{2}}$ – the probability density function in normal distribution.

$$\frac{\partial P}{\partial Strike} = \frac{\partial C}{\partial Strike} + 1$$

$$\frac{\partial \sigma}{\partial y} = 0.01 \cdot (\cdot (2 \cdot b \cdot c \cdot y \cdot Exp(-c \cdot y^2) + \frac{d}{1 + e^2 y^2})$$

Notes: adding multiplier 0.01 to the differential calculus aims to convert the dimension of implied volatility into a unit fraction. The operation is made due to the dimension of coefficients s,a,b,c,d,e.

The monotonicity test is performed:

$$\begin{cases} \frac{\partial C}{\partial Strike} \leq 0 \\ \frac{\partial P}{\partial Strike} \geq 0 \end{cases}$$

If the volatility curve is not monotonic, its parameters are given their most recent values.

VI. Restrictions on curve parameters

1. Upper and lower limits are put on parameters param(1÷6). All or some limits may be omitted.

2. If the Supporting Volatility Curve has been determined, parameters of the curve must not differ from the parameters of the supporting curve by more than the corresponding absolute or relative limit.

3.   Upper and lower limits are placed on volatility σ.

VII.   Miscellaneous

1.   At the beginning of the first Trading Day for an option in the option series (the "first trading day for the option series"), the Clearing Center sets the volatility curve parameters for that option series subject to principles set out in paragraphs 1.1-1.3 of this Section.

    1.1.   If the Supporting Volatility Curve has been determined for the option series on the first trading day, parameters of the volatility curve for that Series are set equal to the parameters of the supporting curve;

    1.2.   If the Supporting Volatility Curve has not been determined for the option series on the first trading day, parameters of the volatility curve for that series are set as follows:

- $b=0$, $c=1$, $d=0$, $e=1$, $s=0$, parameter a is determined by expert opinion,

where b, c, d, e, s, a – the volatility curve parameters according to Section III of this Part.

    1.3. On the first trading day for the option series, the Clearing Center may set other volatility curve parameters.

Appendix 1. Procedure for changing risk parameters on days when foreign exchanges are closed

1. The Clearing Center may change the risk parameters for MOEX derivatives contracts for the settlement day that is not a trading day for instruments on the same or similar underlying asset on foreign exchanges.

2. In this case, the Clearing Center may change the following risk parameters:

No	Parameter	Symbol
1	The time used to monitor adequacy of the Upper/Lower Limit of the Price Band (in minutes) in respect of the futures during the Settlement Period. It is set by the Clearing Center for every underlying asset.	$FutMonTime(UA)$
3	The maximum number of changes in the limits of the Price Band during the Settlement Period. It is set by the Clearing Center for every underlying asset.	$AutoShiftNumMR(UA)$
4	The width (in a unit fraction) of the price band. Set by the Clearing Center for every underlying asset and every Num.	$RangeFut(Num, UA)$
5	The width (in a unit fraction) of the spread. Set by the Clearing Center for every Calendar Spread Instrument involving futures $Num1$ and $Num2$.	$RangeCS(Num1, Num2, UA)$
6	Minimum margin rates (in percent), $level$=1,2,3. It is set by the Clearing Center individually for every underlying asset.	$MR(UA, level)$

3. The list of dates on which the parameters may be changed and underlying assets in question are posted on the Moscow Exchange's website.