CASH PRODUCTS

MARGIN CALCULATION

INTEGRATED METHOD
SPAN® / CASH CLEARING SYSTEM

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CONTENTS

WARNING

The parameters used in the examples or in the texts of this document are merely indicatory. They are regularly adjusted by the Clearing House, according to market evolution.

In this document, the terms in *italics* are defined in the glossary.

If the readers have any question concerning the calculation of required margins (*total liquidation risk* and *negotiation risk*), they can send them to:

riskinfo@lchclearnet.com

The present document can be viewed in French or English version on the LCH.Clearnet website:

www.lchclearnet.com

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INTRODUCTION

The present brochure describes the calculation method for the margins required for the regulated cash market cleared by LCH.Clearnet SA.

The margin required by LCH.Clearnet SA to its members is supposed to cover the losses that could occur following the liquidation of a failing member's positions.

The calculation method of this margin aims at ensuring the market safety while reducing the costs for financing operations on the market.

By implementing the Clearing System on the cash market; the Clearing House LCH.Clearnet SA chose to harmonize the margin calculation methods on all the market it clears by adapting a world standard to derivatives: the SPAN® method.

The margin required in treasury on the cash market covers two notions:
- The margin required for the *liquidation risk*
- The margin required for the *negotiation risk*

The margin required for the *liquidation risk* is calculated using the SPAN® method, according to an algorithm specific to the cash market (stocks and bonds). This margin will be called *total liquidation risk* in the rest of the document.

This *total liquidation risk* is calculated separately for each *clearing organization* (see glossary). It is only calculated for **guaranteed positions** that **are not yet settled**. It is calculated at the level of the *performance bond account* as it is referred to in the Clearing System terminology; we place the present document at this level.

This *total liquidation risk* should cover the positions value variation in case of unfavorable market evolution. The *total liquidation risk* is described in the first part of the document which details the algorithm used for stocks and the algorithm used for bonds.

The margin required for the *negotiation risk* is calculated outside the SPAN® module. This *negotiation risk* covers the positions' past variations ("marked to market", the equivalent of variation margins on derivatives). It is detailed in the second part.

> **Please note that the terms differ between the Span® files and the treasury statements (see glossary).**
>
> **In the Span® files, the field called "Liquidation Risk" is the first step of the calculation. The field that should be taken into account for obtaining the *total liquidation risk* (or "Couverture exigée risque de liquidation" in treasury) is actually "PB Amount".**

TITLE I   CALCULATING THE TOTAL LIQUIDATION RISK

GENERAL DIAGRAM OF THE SPAN® ALGORITHM

```
                    ┌──────────────────────────┐
                    │   PB Account level:      │
                    │ Net positions by securities │
                    └──────────────────────────┘
                                 │
                                 ▼
   ┌─────────┐       ┌──────────────────────────┐       ┌─────────┐
   │ STOCKS  │       │ Assignment to classes according │   │ BONDS   │
   │         │       │   to security category   │       │         │
   └─────────┘       └──────────────────────────┘       └─────────┘
```

Liquidity Class	**Duration Class**
Determining the calculation base	**Determining the calculation base**
overall net positions by class | overall gross positions by class	overall net positions by class | overall gross positions by class
Calculating the intermediary liquidation risk	**Calculating the intermediary liquidation risk**
	Calculating the duration intra-class charge
Calculating the liquidity inter-classes credit	**Calculating the duration inter-classes credit**
Calculating the final liquidation risk: Intermediary liquidation risk + Liquidity inter-classes credit (<0)	**Calculating the final liquidation risk**: Intermediary liquidation risk + Duration intra-class charge + Duration inter-classes credit (<0)

Calculating the total liquidation risk:
Sum of the final liquidation risks for liquidity classes
+ Sum of the final liquidation risks for duration classes

I. ALGORITHM FOR STOCKS

<u>Reminder</u>: only **guaranteed** and **not yet settled** positions will be used by the SPAN® algorithm for calculation.

For a given member, calculations are made at the level of *performance bond accounts* (*PB Account*). At this level, there is a single net buying or a single net selling position by security.

Fails are taken into account in the house *PB Account* calculations.

I.1. Assignment to a liquidity class

The first step consists in assigning the securities to *liquidity classes*. This assignment is executed each day.

These classes are defined by the Clearing House according to the product type and the security's liquidity. This liquidity is represented in a general way by a quotation category (see appendix 2).

The Clearing House can modify the assignment of a security to a class.

Example:

If we take a House PB Account for the member AAA, PBAAAM001 with the following positions:

Security	Net buying position (number of securities)	Net selling position (number of securities)	Assignment to a *liquidity class*
Accor	500	0	LIQ01
Bis	0	150	LIQ02
Saint-Gobain	0	800	LIQ01
Carbonne lorraine	350	0	LIQ02
Carrefour	0	1200	LIQ01
Banque Transatl.	200	0	LIQ03
Infogramme int.	800	0	LIQ02

I.2. Determining the calculation base

This calculation base will be defined at the level of *PB Account* and of the *liquidity classes*, securities will not appear as such in the later steps.

I.2.1. Valuing the net positions by securities

Inside each *liquidity class*, the net buying or selling positions **by securities** are valued by multiplying the number of securities by their reference price (last quoted price which is adjusted with corporate events). We have then valued buying and selling positions by *liquidity class*.

Systematically, within a given *liquidity class*, the sum of valued buying positions will be designated by **BP** and the sum of valued selling positions by **SP**.

If a quoted price is not available for a given security, the position on this security will be ignored and will not be included in the calculation of the *final liquidation risk*.

If we take the previous example again:

Liquidity class	security	side	Position (number of securities)	Reference price	BP In Euro	SP In Euro
LIQ01	Accor	B	500	47.04	23 520	
	Saint-Gobain	S	800	157.60		126 080
	Carrefour	S	1200	70.10		84 120
Total for the *liquidity class* LIQ01					**23 520**	**210 200**
LIQ02	Bis	S	150	151		22 650
	Carbonne Lorraine	B	350	54.1	18 935	
	Infogramme Int.	B	800	25.11	20 088	
Total for the *liquidity class* LIQ02					**39 023**	**22 650**
LIQ03	Bque Transatl.	B	200	67.60	13 520	
Total for the *liquidity class* LIQ03					**13 520**	**0**

I.2.2. Determining an overall net position by liquidity class

The ***overall net position*** is calculated by *liquidity class*. It corresponds to the difference within a given class between the sum of the valued buying positions(BP) and the sum of the valued selling positions (SP). This *overall net position* has an absolute value.

Overall net position = │**BP - SP**│

If we take the previous example again:

Liquidity class	BP	SP	overall net position = │BP - SP│
LIQ01	23 520	210 200	**186 680**
LIQ02	39 023	22 650	**16 373**
LIQ03	13 520	0	**13 520**

I.2.3. Determining an overall gross position by liquidity class

The **overall gross position** is calculated by *liquidity class*. It corresponds to the sum within a given class, of the sum of the valued buying positions (BP) and the sum of the valued selling positions (SP).

Overall gross position = **BP + SP**

If we take the previous example again:

Liquidity class	BP	SP	overall gross position = $\lvert BP + SP \rvert$
LIQ01	23 520	210 200	**233 720**
LIQ02	39 023	22 650	**61 673**
LIQ03	13 520	0	**13 520**

I.3. Calculating the intermediary liquidation risk

The intermediary liquidation risk is the sum of the specific risk and of the general market risk.

This risk is calculated by *PB Account* and for each *liquidity class*.

I.3.1. Specific risk

The *specific risk* must cover the variations of a given stock that would move away from the general market movement, because of its own characteristics.

It is measured by a coefficient **x** and is applied on the **overall gross position**.

There is one *specific risk* by *Liquidity class*.

$$\textbf{\textit{Specific risk}} = x\% \times (BP + SP)$$

I.3.2. General market risk

The *general market risk* must cover the variations of a market segment, and in our case, the segment corresponding to one *Liquidity class*.

It is measured by a coefficient **y** and is applied on the **overall net position**.

There is one *general market risk* by *Liquidity class*.

$$\textbf{\textit{General market risk}} = y\% \times \lvert BP - SP \rvert$$

I.3.3. Calculating the intermediary liquidation risk

The Intermediary liquidation risk = x % (*overall gross position*) + y % (*overall net position*)

$$\textbf{\textit{Intermediary liquidation risk}} = x\% \times (BP + SP) + y\% \times |BP - SP|$$

The calculation is made with 5 decimals, and then rounded and stored with 2 decimals.

Coefficients x and y are *Margin parameters* set and published by the Clearing House which can modify them according to market evolution.

Example: If we examine the Performance Bond account PBAAAM001 of the previous example, we have:

Margin parameters

liquidity class	x (*specific risk*)	y (*general risk*)
LIQ01	2 %	5 %
LIQ02	3 %	6 %
LIQ03	3 %	7 %

All amounts are in Euro

liquidity class	x % (1)	y % (2)	*overall gross position* (3)	*overall net position* (4)	*specific risk* (5)=(1)*(3)	general risk (6)=(2)*(4)	*intermediary liquidation risk* (5)+(6)
LIQ01	2 %	5 %	233 720	186 680	4 674.4	9 334	14 008.4
LIQ02	3 %	6 %	61 673	16 373	1 850.19	982.38	2 832.57
LIQ03	3 %	7 %	13 520	13 520	405.6	946.4	1 352

I.4. Calculating the liquidity inter-classes credit

This credit allows to reduce the *intermediary liquidation risk* by taking into account the correlation between the different *liquidity classes*.

It is measured by the **inter coefficient** applied to the **overall net position**. This credit will reduce the *intermediary liquidation risk* of the two *liquidity classes* concerned.

To calculate it, the *overall net positions* of the *liquidity classes* must be examined in pairs, according to **priorities** defined by the Clearing House.
To be taken into account in the credit calculation, the *overall net positions* must have opposite sides; i.e. one must be a buying position for a class, and the other must be a selling position for the other class.

As a matter of fact, a portfolio which is globally buying on a *liquidity class* and globally selling on another class is less exposed to the *general market risk* than a portfolio having the same side on both classes.
In case of a general rise of the market, the losses of the selling portfolio on a given class will be counterbalanced by the gains of the buying portfolio on another class. It implies correlated classes evolving in the same direction.

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Once the *overall net positions* of opposite sides have been identified, their absolute value is taken and the credit shall be calculated over the smallest common value.

The amount of the credit is negative, it is therefore added to the *intermediary liquidation risk* to reduce it.
It is calculated and stored with two decimals.

The general formula is, if $(BP - SP)_a$ and $(BP- SP)_b$ have opposite sides:

Credit (LIQ_a/LIQ_b) = **-** *Coef. Inter* x Min { $\|BP - SP\|_a$; $\|BP - SP\|_b$ }

If the *overall net position* of the *liquidity class* (a) is the most important:
- A residual *overall net position* is recalculated for this class (a), and it shall be equal to the initial *overall net position* minus the *overall net position* of the *liquidity class* (b) (i.e. the position on which the credit was calculated).
- Another *liquidity class overall net position* of opposite side suitable to calculate a new credit is searched according to priority ranks.
- The operation is repeated as long as any *overall net position* is left and as long as it is possible to constitute credit with other *liquidity classes* the *overall net positions* of which have opposite sides.

The *inter coefficient* and the priorities are *Margin parameters* set and published by the Clearing House which can modify them according to market evolution.

Example: If we examine the account PBAAAM001 of the previous example, we have:

Margin parameters

Priority	*Liquidity class* **a**	Side(1)	*Liquidity class* **b**	Side(1)	*Inter coefficient* **(2)**
1	LIQ01	A	LIQ02	B	2.75 %
2	LIQ02	A	LIQ03	B	3.25 %
3	LIQ01	A	LIQ03	B	3 %

(1) by convention A/B means that positions must have opposite sides.

(2) According to our studies concerning the correlation between the different liquidity classes, we have estimated that the **general market risk (y) could be reduced by 50 %** *over the two liquidity classes concerned. To find the inter coefficient between two liquidity classes a and b, you should use the following formula: $(0.5*y_a+0.5*y_b)/2$*

Determining the buying or selling overall net positions by liquidity class:

Liquidity class	Buying *overall net position*	Selling *overall net position*
LIQ01		186 680
LIQ02	16 373	
LIQ03	13 520	

Overall net positions left when priorities have been used

Class	Buying *overall net position*				Selling *overall net position*			
	Positions available for priorities				Positions available for priorities			
	1	2	3	remainder	1	2	3	remainder
LIQ01					186 680	170 307	170 307	156 787
LIQ02	16 373	0						
LIQ03	13 520	13 520	13 520	0				

Calculating the credit on the overall net positions:

Priority	B	S	Min(B;S)	Credit
1 (LIQ01/LIQ02)	16 373	186 680	16 373	- 450.26
2 (LIQ02/LIQ03)				
3 (LIQ01/LIQ03)	13 520	170 307	13 520	- 405.6

The credit will affect both the liquidity classes concerned

Liquidity class	Credit
LIQ01	(- 450.26 - 405.6)= - 855.86
LIQ02	- 450.26
LIQ03	- 405.6

I.5. Calculating the final liquidation risk

This calculation is made at the level of the *PB Account* and by *liquidity class*.
It is equal to the sum of the intermediary liquidation risk and the liquidity inter-classes credit.

<u>Reminder</u>: the amount of credit are negative.

If we use our previous example again, we have:

PBAAAM001

Liquidity class	Intermediary liquidation risk	inter-classes credit	Final liquidation risk
LIQ01	14 008.4	- 855.86	**13 152.54**
LIQ02	2 832.57	- 450.26	**2 382.31**
LIQ03	1 352	- 405.6	**946.4**

II. ALGORITHM FOR BONDS

Reminder: only **guaranteed** and **not yet settled** positions will used by the SPAN® algorithm calculation.

For a given member, calculations are made at the level of the *performance bond account* (*PB Account*). At this level, there is a single net buying or a single net selling position by security.

Fails are taken into account in the calculations of the house *PB Account*.

II.1. Assignment to a duration class

Each security is automatically assigned to a *duration class* according to its *modified duration* and its *rating*. The assignment is made each day and the clearing house can modify it according to risk criteria.

Duration classes are defined by the Clearing House. They will result from the cross between a *modified duration* range and a *rating* category (see the appendix 3).

Example:

If we consider a house PB Account of member AAA, PBAAAM001 with the following positions:

Security	Net buying position (number of bonds)	Net selling position (number of bonds)	Assignment to a *duration class*
CFF 9.7% 18/06/02	10	0	DUR01
Paribas 9.2% 18/11/02	0	15	DUR01
CNA 10.2% 14/05/02	0	20	DUR01
Paribas 9% 12/12/00	0	30	DUR02
Paribas 8.7% 20/02/01	50	0	DUR02

II.2. Determining the calculation base

The calculation base will be defined at the level of *PB Account* and of the *duration classes*. Securities will not appear as such in later steps.

II.2.1. Valuing the net positions by security

Within each *duration class*, positions are valued by multiplying the number of securities by its reference price and by its *modified duration*. The reference price is the last quoted price or this price adjusted in case of specific corporate events. We have then valued buying and selling positions by *duration class*.

Systematically, within a given *duration class*, the sum of valued buying positions will be designated by **BP** and the sum of valued selling positions by **SP**.

Example:

Valuing net positions of securities for the house PB Account of member AAA (PBAAAM001)

Duration class	**Security**	**Side**	**Position (number of securities)**	*Modified duration*	**Reference price**	**BP in Euro**	**SP in Euro**
DUR01	CFF 9.7% 18/06/02	B	10	1.39	841.58	11 697.96	
	Paribas 9.2% 18/11/02	S	15	0.92	788.31		10 878.67
	CNA 10.2% 14/05/02	S	20	1.29	851.74		21 974.89
Total for the *duration class*:						**11 697.96**	**32 853.56**
DUR02	Paribas 9% 12/12/00	S	30	0.04	829.01		994.81
	Paribas 8.7% 20/02/01	B	50	0.21	817.33	8 581.96	
Total for the *duration class*:						**8 581.96**	**994.81**

The *modified duration* has 4 decimals, the prices have 7 decimals, and the result is stored with 2 decimals.

II.2.2. Determining an overall net position by duration class

The ***overall net position*** is calculating by the difference between the sum of the valued buying positions (BP) and the sum of the valued selling positions (SP). This *overall net position* is set in absolute value and is calculated by *duration class*.

Overall net position = │**BP - SP**│

If we use our previous example again, we have:

Duration class	**BP**	**SP**	*overall net position =* │BP - SP │
DUR01	11 697.96	32 853.56	21 155.6
DUR02	8 581.96	994.81	7 587.15

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II.2.3. Determining an overall gross position by duration class

The **overall gross position** is calculating by the difference between the sum of the valued buying positions (BP) and the sum of the valued selling positions (SP). It is calculated by *duration class*.

Overall gross position = **BP + SP**

If we use our previous example again, we have:

Duration class	**BP**	**SP**	*overall gross position =* **BP + SP**
DUR01	11 697.96	32 853.56	44 551.52
DUR02	8 581.96	994.81	9 576.77

II.3. Calculating the intermediary liquidation risk

The *intermediary liquidation risk* results from the sum of the *specific risk* and the *general market risk*.
This risk is calculated by *PB Account* and for each *duration class*.

II.3.1. Specific risk

The *specific risk* must cover the excess variation of a given security compared to the general market variation. It allows to take into account different risks according to security categories.

The *specific risk* is measured by the coefficient x and is applied to the **overall gross position**. A coefficient x is defined for each *duration class* (*modified duration*/*rating* couple).

Specific risk = $x\% \times (BP + SP)$

II.3.2. General market risk

The *general market risk* covers the uniform translation risk of the yield curve segment corresponding to a given class.

It is measured by the coefficient y and is applied to the **overall net position**. One coefficient *y* is defined for each *duration class*.

General market risk = $y\% \times |BP - SP|$

II.3.3. Calculating the intermediary liquidation risk

The *intermediary liquidation risk* = x % (*overall gross position*) + y % (*overall net position*)

$$\textbf{\textit{Intermediary liquidation risk}} = x\% \times (BP + SP) + y\% \times |BP - SP|$$

The calculation is made with 5 decimals, and then rounded and stored with 2 decimals.

Coefficients x and y are *Margin parameters* set and published by the Clearing House, which can modify them according to market evolution.
They are homogenous with interest rate variations.

Example:

If we consider again our PB account, PBAAAM001, we have:

Duration class	x% (1)	y% (2)	overall gross position (3)	overall net position (4)	specific risk (1)*(3)	general risk (2)*(4)	Intermediary liquidation risk (1)*(3)+ (2)*(4)
DUR01	0.15%	0.25%	44 551.52	21 155.60	66.83	52.89	119.72
DUR02	0.2%	0.3%	9 576.77	7 587.15	19.15	22.76	41.91

II.4. Calculating the duration intra-class charge

It covers the risk not taken into account when calculating the general market risk because of the offsetting, within a single class, of securities not perfectly correlated. Precisely, its aim is to cover, for a given duration class, any non-uniform evolution of this segment in the yield curve (yield curve twist risk within a single class).

The charge is applied to buying (BP) and selling (SP) positions that are offsetted within a single *duration class,* for calculating the *general market risk*.

$$\textit{Duration intra-class charge} = \textit{Intra Coef.} \times \text{Min} (|BP|, |SP|)$$

Example:

If we consider again our PB account, PBAAAM001, we have

Duration class	Intra coefficient	Min ($|BP|, |SP|$)	Intra-class charge
DUR1	0.15%	11 697.96	17.55
DUR2	0.20%	994.81	1.99

II.5. Calculating the duration inter-classes credit

Inter-classes credit are calculated on the *general market risk*. They allow to reduce the *intermediary liquidation risk* by taking into account the correlation between the different *duration classes*.

To calculate these credits, the *overall net positions* of the *duration classes* must be examined in pairs, according to **priorities** defined by the Clearing House.
To be taken into account in the credit calculation, the *overall net positions* must have opposite sides; i.e. one must be buying on a class, and the other must be selling on the other class.

When the *overall net positions* of opposite sides have been identified, their absolute value is taken and the credit is calculated on the smallest common value.

The amount of the credit is negative, and therefore added to the *intermediary liquidation risk*.

It is calculated and stored with two decimals.

Credit $(DUR_a/DUR_b) = -$ *Coef. Inter* x Min $\{ |BP - SP|_a ; |BP - SP|_b \}$

If the *overall net position* of the *duration class* (a) is the most important:
- A residual *overall net position* is recalculated for this classe (a). This residual *overall net position* will be equal to the initial *overall net position* minus the *overall net position* of the *duration class* (b) (i.e. the position on which the credit was calculated).
- Another *overall net position duration class* of opposite side suitable to calculate a new credit is searched according to priority ranks.
- The operation is repeated as long as any *overall net position* is left and as long as it is possible to constitute credit with other *duration classes* the Overall Net Positions of which have opposite sides.

The *inter coefficient* and the priorities are *Margin parameters* set and published by the Clearing House which can modify them according to market evolution.

Example:

Calculating duration inter-classes credit for the house PB Account of member AAA (PBAAAM001)

Margin parameters

Priority	*Duration class* **a**	Side(1)	*Duration class* **b**	Side(1)	*Coefficient inter*
1	DUR01	A	DUR02	B	0.1%

(1) by convention A/B means that positions must have opposite sides.

Determining buying or selling overall net positions

Duration class	Buying *overall net position*	Selling *overall net position*
DUR01		21 155.60
DUR02	7 587.15	

Calculating the credit on the overall net positions

Priority	A	B	Min(A.B)	Credit
(DUR01/DUR02)	7 587.15	21 155.60	7 587.15	-7.59

II.6. Calculating the final liquidation risk

The *final liquidation risk* is calculated at the level of the *PB Account*, by *duration class*.

For a given *duration class* the *final liquidation risk* is equal to the sum of the *intermediary liquidation risk*, the *duration intra-class charge*, and the *duration inter-classes credit*.
As the *duration inter-classes credit* is posted negatively, it is subtracted from the sum.

Example: Calculating the intermediary liquidation risk for the house PB Account of member AAA (PBAAAM001)

Liquidity class	intermediary liquidation risk	duration intra-class charge	duration inter-classes credit	Final liquidation risk
DUR01	119.72	17.55	-7.59	129.68
DUR02	41.91	1.99	-7.59	36.31

III. CALCULATING THE TOTAL LIQUIDATION RISK

To obtain the *total liquidation risk*, follow the steps below:
- by *PB Account* according to the segregation type (house, clients) :
  - ➢ sum the *final liquidation risks* of the different *liquidity classes* **(1)**
  - ➢ sum the *final liquidation risks* of the different *duration classes* **(2)**
  - ➢   (1) + (2) = **(3)** : this operation provides one *total liquidation risk* by *PB Account*
- the results of these *PB Account* are added, to obtain a single *total liquidation risk* by segregation type.

Reminder: fails are recovered with house positions.

Example with a member AAA: all amounts are in Euro

PB Account	(1)	(2)	total liquidation risk (3)=(1)+(2)
PBAAAM001	16 479.9	165.99	16 481.25
Total for the House segregation type			**16 481.25**
PBAAAC001	15 000	1 600	16 600
PBAAAC002	12 338	500	12 838
Total for the Clients segregation type			**29 438**

TITLE II CALCULATING THE NEGOTIATION RISK

The *negotiation risk* is calculated for all **trades guaranteed** by LCH.Clearnet SA, **and not settled yet**.

This calculation is made for each *PB Account*, at the level of net positions by security.

It is the difference between the buying or selling positions revalued at a reference price and the cash positions at the trading price (cash balance to settle).

I. Selected reference price

I.1. For securities involved in specific corporate events

Special prices set by LCH.Clearnet SA for securities involved in specific corporate events, are selected for calculating the *negotiation risk,* but only for positions whose settlement dates are included in the period of the operation.

I.2. For securities not involved in specific corporate events

The buying reference price (respectively the selling reference price) determined every day is either the last quoted price adjusted with the corporate events, or the aforementioned price credited by a coefficient C_{ai} (respectively charged by a coefficient C_{vi}) to increase the *negotiation risk* in order to anticipate a price variation specific to the security.
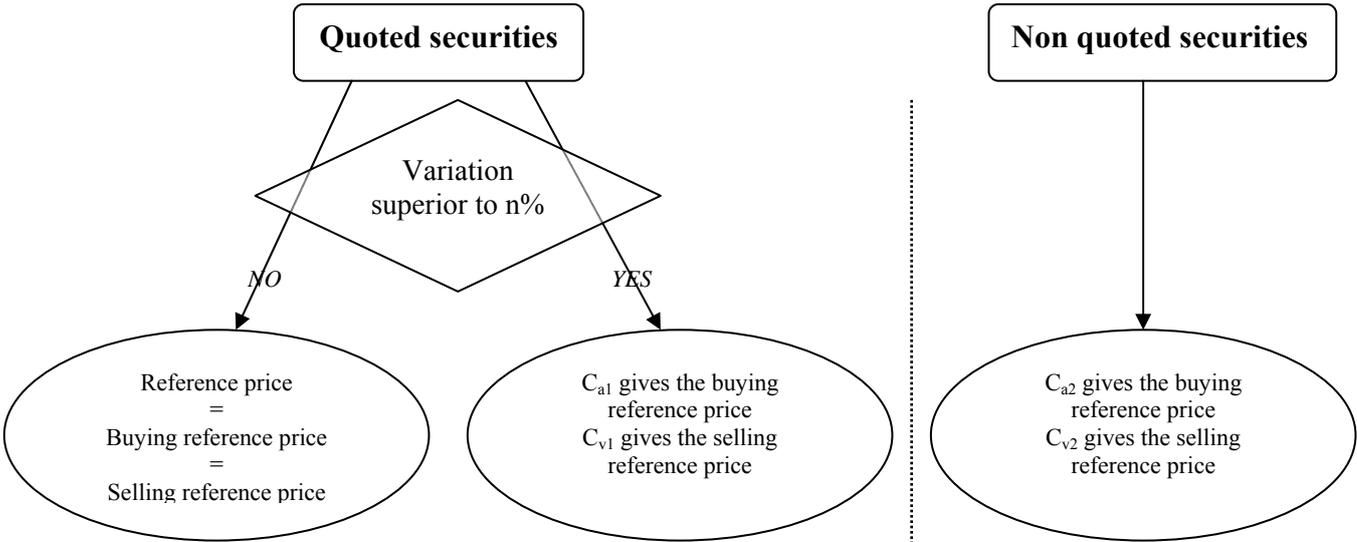
The security was quoted:
- **If the variation with the previous day reference price is strictly superior to n%,** then the reference price is credited by the coefficient C_{a1}, — which gives the selected buying reference price — and charged by the coefficient C_{v1} – which gives the selling selected reference price:

$$\text{Buying reference price} = \text{Reference price} * (1 - C_{a1})$$
$$\text{Selling reference price} = \text{Reference price} * (1 + C_{v1})$$

- **If the variation with the previous day reference price is strictly inferior to n%,** then the selected buying reference price is equal to the selected selling reference price which in turn is equal to the reference price.

$$\text{Selected buying reference price} = \text{Selected selling reference price} = \text{Reference price}$$

The security was not quoted:
The previous day reference price is credited by the coefficient C_{a2}, — which gives the selected buying reference price — and charged by the C_{v2} – which gives the selling selected reference price.

$$\text{Selected buying reference price} = \text{Reference price} * (1 - C_{a2})$$
$$\text{Selected selling reference price} = \text{Reference price} * (1 + C_{v2})$$

Coefficients C_{a1}, C_{v1}, n%, C_{a2}, C_{v2} are set and published by LCH.Clearnet SA.

Note:
If there is no reference price for a given security, no *negotiation risk* will be calculated on this security's positions.

Below is an example of selected reference prices calculated for three distinct securities.

The coefficients selected in this example are:

C_{a1}	C_{v1}	n	C_{a2}	C_{v2}
5%	5%	10%	3%	3%

The Danone security represents a normal case, Elf Aquitaine represents the case of a variation superior to the coefficient n, and Le Tanneur represents a case of non quotation.

Security	Danone	Elf Aquitaine	Le Tanneur
Previous day reference price	161.30	171.50	12.81
Reference price	155.60	152.80	12.81[*]
Variation	-3.53%	-10.90%	-
Selected buying reference price	155.60	145.16	12.43

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[*] This reference price is the price of the previous day, which has been carried forward. It becomes the reference price for the day. Therefore, if the following day the security is still not quoted, this price will be carried forward until the security is quoted.

Selected selling reference price	155.60	160.44	13.19

II. Calculating the negotiation risk

The *negotiation risk* – the difference between the security position revaluation and the cash balance to settle (sum of the trades at the trading price) – reflects the loss or the gain that would be caused by the complete liquidation of the position following the market conditions at the last close, the future risk being covered by the *total liquidation risk*(cf. supra).

This calculation is executed for each security i according to the following formula, for which gains are considered positive and losses negative:

Negotiation risk $_i$ = Balance to settle $_i$ + (BP$_i$ - SP$_i$) * Selected reference price

where, BP$_i$ is the quantity of bought securities and SP$_i$ the quantity of sold securities.

To obtain an amount at the level of the *PB Account* (positive if it is a gain and negative if it is a loss), the *negotiation risk* is sum by *PB Account*, for all securities.

$$negotiation\ risk\ _{PB\ Account} = \sum_i negotiation\ risk\ _i$$

The *negotiation risk* required at the level of the segregation type (client, house,…) is the sum of absolute values of all the losses calculated by *PB Account*, for *PB Account* belonging to the same segregation type.

$$Required\ negotiation\ risk = \sum_{PBAccount} |Min(negotiation\ risk\ _{PB\ Account}\ ,\ 0)|$$

Example:

The negotiation risk is calculated for three distinct PB Account (PBAAAC001, PBAAAC002 for client positions and PBAAAM001 for house positions) in which are recorded the positions of three different securities: Danone, Elf Aquitaine, Le Tanneur.

Prices used for revaluation are the prices determined in the example above.

At the level of the PB Account:

	Security	**BP$_i$**	**SP$_i$**	**Position to settle**	**Revalued position**	**Negotiation risk**
PBAAAC001	Danone	0	10	1 500.00	-1 556.00	-56.00
	Elf Aquitaine	50	0	-7 400.00	7 258.00	-142.00
	Le Tanneur	30	0	-330.00	372.9	42.9
Total						**-155.1**
PBAAAC002	Danone	20	0	-2 960.00	3112.00	152.00
	Elf Aquitaine	0	45	7 110.00	-7 219.80	-109.80
	Le Tanneur	0	25	350.00	-329.75	20.25
Total						**62.45**
PBAAAM001	Le Tanneur	20	0	-290.00	263.80	-26.20
Total						**-26.20**

At the clearing member level, by segregation:

PB Account	Segregation	Negotiation risk	Required negotiation risk
PBAAAC001	**Client**	-155.1	155.1
PBAAAC002		62.45	0.00
	Total		**155.1**
PBAAAM001	**House**	-26.20	26.20
	Total		**26.20**

APPENDIX 1

Correspondence between the terms of the brochure, the files provided by the Cash Clearing System, and the treasury statements (one by Clearing Organization).

Liquidation Risk

Brochure	"PB Result" file	Treasury statement
intermediary liquidation risk	Liquidation Risk amount	
duration intra-class charge	Intra-commodity spread charges amount	
duration or liquidity inter-classes credit	Inter-commodity spread credits amount	
final liquidation risk	Performance Bond amount	
total liquidation risk		COUVERTURE EXIGEE RISQUE DE LIQUIDATION

Brochure	"SPAN®" files	Record number[1]
Assignment of duration or liquidity classes to each security	Combined Commodity / Product Family	2
Duration or liquidity class	Combined Commodity (BFCC)	2
Specific risk (x) and general market risk (y) coefficients	Specific Risk Cover Percentage Generic Risk Cover Percentage	33
Duration intra-class charge coefficients	Intra Spread Charge Percentage	33
Duration or liquidity inter-classes credit coefficients and priority	Inter Spread Credit Rate Spread Priority	66
Reference price	Settlement Price	9
Modified duration	Modify duration	9

Negotiation risk

Brochure	"Position Result" File	Treasury statement
Selected reference price for buying or selling	Price for record # 30 000	
BP_i - SP_i	Buy quantity - Sell quantity	
Balance to settle	Debit valuation et Credit valuation	
Required negotiation risk		COUVERTURE EXIGEE RISQUE DE NEGOCIATION

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[1] For more information on these files, please see the appropriate documents on Clearing 21® Web site.

APPENDIX2

Assignment of securities to the liquidity classes

Clearing Organization SBF

Quotation Group	Security Type	Designation of the Quotation Group or of the Security Type	*Liquidity class*
01		VALEURS DE L'INDICE CAC40	LIQ01
05		VALEURS NOUVELLEMENT PRIVATISEE	LIQ01
11		ACTIONS CONTINU A RM 2EME GROUPE	LIQ01
16		ACTIONS CONTINU A COMPTANT	LIQ01
21		ACTIONS ETRANGERES CONTINU A RM	LIQ01
22		ACTIONS ETRANGERES CONTINU A COMPTANT	LIQ01
31		ACTIONS CONTINU A COMPTANT LIGNES SECONDAIRES	LIQ01
32		ACTIONS CONTINU A RM LIGNES SECONDAIRES	LIQ01
12		ACTIONS CONTINU B COMPTANT	LIQ02
17		ACTIONS CONTINU B RM	LIQ02
57		OPTIONS SUR VALEURS ETRANGERES	LIQ02
97		SHIVA RM	LIQ02
98		SHIVA CT	LIQ02
13		ACTIONS FRANCAISE FIXING A	LIQ03
23		ACTIONS ETRANGERES FIXING A	LIQ03
33		ACTIONS FIXING A LIGNES SECONDAIRES	LIQ03
35		OBLIG. CONVERTIBLE CONTINU A	LIQ04
41		OBLIGATIONS CONTINU A	LIQ04
46		CERTIFICATS CONTINU A	LIQ04
42		OBLIGATIONS CONTINU B	LIQ04
37		OBLIG. CONVERTIBLE FIXING A	LIQ04
43		OBLIGATIONS FIXING A	LIQ04
48		CERTIFICATS FIXING A	LIQ04
10		MARCHE LIBRE LIGNES PRINCIPALES	LIQ04
19		LIGNES PRINCIPALES RADIEES M. REGLEMENTES	LIQ04
30		MARCHE LIBRE LIGNES DERIVEES	LIQ04
36		WARRANTS CONTINU A	LIQ04
38		WARRANTS FIXING A	LIQ04
39		LIGNES DERIVEES RADIEES DE M. REGLEMENTES	LIQ04
	021	OBLIGATION CONVERTIBLE	LIQ04
	022	OBLIGATION ECHANGEABLE	LIQ04
	071	BON DE PRODUITS DIVERS	LIQ04
	072	BON D'ACTION	LIQ04
	075	DIVERS	LIQ04
	086	ACTION DE SOCIETE CAPITAL-RISQUE	LIQ04
	105	BON D'INDICES	LIQ04
	106	BON SUR DEVISES	LIQ04
	108	BON DE BON	LIQ04
	110	BON DE TITLE PARTICIPATIF	LIQ04
	111	TITLE SUBORDONNE CONVERTIBLE	LIQ04
	121	OBLIGATION CONVERTIBLE A BON ATTACHE	LIQ04
	123	OBLIGATION PARTICIPANTE CONVERTIBLE	LIQ04
	145	BON DE CERTIF. D'INVESTISSEMENT	LIQ04
	162	PART FONDS COMMUN DE CREANCES	LIQ04
	200	BON DE BON DE PARTICIPATION	LIQ04
	221	OBLIGATION CONVERTIBLE EX BON ATTACHE	LIQ04
	247	CERTIFICAT DE VALEUR GARANTIE	LIQ04

	248	WARRANT D'ACTION	LIQ04
	257	CERTIFICAT INDEXE	LIQ04
	262	CERTIFICAT INDEXE - EMTN	LIQ04

Clearing Organization SNM

Quotation Group	Security Type	Designation of the Quotation Group or of the Security Type	*Liquidity class*
70		NOUVEAU MARCHE - VALEURS FRANCAISES	LIQ71
71		NM DOUBLE LISTING CONTINU	LIQ71
72		FIXING NOUVEAU MARCHE	LIQ71
73		DERIVEES NOUVEAU MARCHE	LIQ71
76		NM LIGNES SECONDAIRES CONTINU	LIQ71
99		SHIVA NM	LIQ71

The Clearing House can modify the assignment of some securities according to market criteria.

Reminder: This assignment is available daily in the Span® files (record # 2).

APPENDIX 3

Assignment of bonds to duration classes

Eventually, we will assign securities to duration classes as follows:

Modified duration	Rating		
	[AAA ; AA]	[AA- ; BBB]	[BBB- …[
[0 ; 1[	DUR01	**DUR04**	DUR07
[1 ; 4[	DUR02	**DUR05**	DUR08
[4 et +[	DUR03	**DUR06**	DUR09

At the startup, there will be only three classes distributed according to modified duration criteria (in bold cases in the table).

The Clearing House can modify the assignment of some securities according to market criteria.

Reminder: This assignment is available daily in the Span® files (record # 2).

GLOSSARY

Clearing Organization (CO)

Technical compartment (there is only one clearing house: LCH.CLEARNET SA). The Clearing System works for the four compartments called MATIF, MONEP, SBF and SNM.

Duration class (Combined Commodity)

Group of securities (bonds and comparable categories) with close modified duration and rating. This notion corresponds to the Combined Commodity in the SPAN® file and is used in the calculation of the final liquidation risk which is calculated by duration class for bonds and comparable categories.

Duration intra-class charge

It only exists for bonds and comparable categories.
The charge covers the risk not taken into account when calculating the general market risk because of the offsetting within a single class of values not perfectly correlated. Precisely, its objective is to cover, for a given duration class, any non-uniform evolution of this segment in the yield curve (yield curve twist risk within a single class). It is measured by the intra coefficient.

Final liquidation risk (at the level of the PB Account)

Cf. PB Amount.

General market risk

For stocks or comparable categories:
The general market risk must cover the variations of a market segment. In our case, the segment corresponds to a Liquidity class. It is measured by the coefficient y.

For bonds or comparable categories:
The general market risk covers the uniform translation risk of the yield curve's segment corresponding to a given duration class. It is measured by the coefficient y.

Inter and intra coefficient

See inter-classes credit and duration intra-class charge

Inter-classes credit

Liquidity inter-classes credit for stocks and comparable categories:
This credit allows to reduce the intermediary liquidation risk by taking into account the correlation between the different liquidity classes. It is measured by the inter coefficient. This credit will reduce the intermediary liquidation risk of the two liquidity classes concerned.

Duration inter-classes credit for bonds and comparable categories:
Inter-classes are calculating using the general market risk. They allow to reduce the intermediary liquidation risk by taking into account the correlation between the different duration classes. It is measured by the inter coefficient. This credit will reduce the intermediary liquidation risk of the two liquidity classes concerned

Intermediary liquidation risk

It is calculated by liquidity or duration class. It is the sum of the general market risk and of the specific risk. This amount corresponds to the "Liquidation Risk" in the Cash Clearing System Performance Bond files.

Liquidity class (Combined Commodity)

Group of securities (stocks and comparable categories) with a common liquidity or common characteristics (for example, all stocks of the Continu A or underlying securities). This notion corresponds to the Combined Commodity in the SPAN® file and is used in the calculation of the final liquidation risk which is calculated by liquidity class for stocks and comparable categories.

Liquidation risk (Total liquidation risk in this document)

Cf. PB Amount

Margin parameters

Parameters set by the Clearing House and used to calculate the required margin.
They are the base elements used by the Cash Clearing System to calculate.
They include:
For the Liquidation Risk,
- coefficients of specific risk x and of general market risk y,
- duration intra-class charge coefficients,
- duration and liquidity inter-classes credit coefficients[2].

For the negotiation risk,

- charge/credit coefficients for the reference price in case of a significant variation and the stop-loss threshold (n, C_{a1}, C_{v1}),
- charge/credit coefficients for the reference price in case of non quotation (C_{a2}, C_{v2}).
-
Modified duration

It is the relative price variation of a bond-type security caused by an incremental variation of the interest rate.

Negotiation risk (at the level of the security or PB Account)

Difference between the valuation of the net position on a security at its trading price, and the valuation at the selected reference price.

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[2] See SPAN® file.

Overall gross position (BP + SP at the level of the liquidity or duration class)

It is calculated by liquidity or duration class. It is the sum of the total of buying positions on the one hand, and of the total of selling positions on the other, they are valued at the reference price, for all securities.

Overall net position (BP - SP at the level of the liquidity or duration class)

It is calculated by liquidity or duration class. It is the difference of the total of buying positions on the one hand, and of the total of selling positions on the other, they are valued at the reference price, for all securities.

PA

Position Account.

PB Account

Performance Bond Account

PB Amount

For stocks,
final liquidation risk =   Intermediary liquidation risk
                          + duration inter-classes credit (<0).

For bonds,
final liquidation risk =   Intermediary liquidation risk
                          + duration intra-class charge
                          + duration inter-classes credit (<0).

Rating

Using ratings emitted by specialized agencies (Standard and Poor's, IBCA …) on each security to affect the securities in the duration classes (see appendix 3).

Reference price

Price set using the last quoted prices adjusted by the corporate events. The reference price is used as a base for calculating the required margins for the liquidation risk on the one hand (see SPAN® file) and the negotiation risk on the other hand (see Position Result file).

Required margin

Called amount used to cover the losses related to position liquidation when a member is failing. It protects the Clearing House, and therefore the other members. This amount is recalculated everyday.

Required negotiation risk (at the level of the member and client, house segregation)

Sum of the negotiation risks at the level of the PB Account after having set to zero the positive amounts (i.e. the gains); only losses are sum for all PB Accounts by client or house segregation. This amount corresponds to the amount on the treasury statements " couverture exigée risque de négociation ".

Selected reference price

It is the reference price selected for calculating the negotiation risk. It can differ between buying and selling operations because of specific corporate events, non quotation, and significant variations of a given security.

Specific risk

<u>For stocks or similar categories</u>:
The specific risk must cover the variations of a given stock which would be moving away from the general market movement because of its own characteristics. It is measured by the coefficient x.

<u>For bonds or similar categories</u>:
Le specific risk must cover the variation excess of a given security compared to the general market variation. It allows to take into account the different risk according to the security categories. It is measured by the coefficient x.

Total liquidation risk (at the level of the member and client, house segregation)

Sum of the final liquidation risks (i.e. sum of the PB Amounts) by segregation. This amount corresponds to the amount on the treasury statements "couverture exigée risque de liquidation".