

## **Annex I to Circular Letter 022/2009-DP**

### **TRADING TUNNEL CALCULATION METHODOLOGY**

The GTS trading tunnel module is composed of rejection tunnels and auction tunnels, which are respectively geared to the insertion of orders into the order book and the execution of trades.

The rejection tunnels, as well as the current price fluctuation limits, determine the price region considered acceptable for trading purposes. However, unlike the price fluctuation limits which are static along a given day, the rejection tunnels are updated dynamically, following the evolution of the market. This characteristic permits the use of narrower price intervals, resulting in a more efficient management of operational risk. Despite the implementation of the rejection tunnels, the fluctuation limits will continue to be in effect, since they have a different purpose in the process of risk management.

The auction tunnels are an enhancement of the current intraday fluctuation limits, as defined in Circular Letter 054/2001, of April 6, 2001. After a trade is executed, while its conformity to the intraday fluctuation limits is verified, the auction tunnels activate, at the imminence of the trade execution, an automatic auction on GTS if the trade price is not within the price interval defined by the tunnel. The auction will use the quantity maximization algorithm, that is, the trades will be executed in one single price. Thus, this new process will increase the agility and transparency of the trading environment.

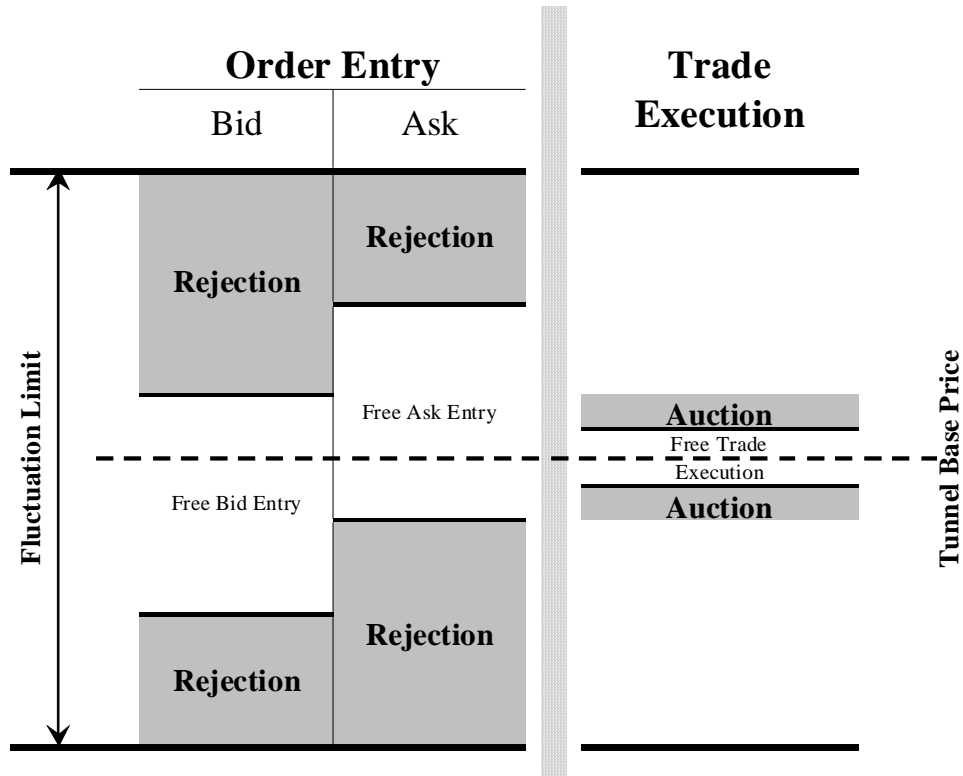
The auction tunnels and the rejection tunnels are defined per instrument group. In the case of rejection tunnels, the Exchange may define one tunnel for a bid and another tunnel for an ask.

Independently of their purpose (rejection or auction), the trading tunnels may be calculated either by the additive or the multiplicative method. In the former, a fixed value (bandwidth) is added to the instrument's referential price in order to determine the upper tunnel limit, while in the latter it is subtracted from the referential price in order to determine the lower tunnel limit. When calculated by the multiplicative method, the lower and upper limits are obtained from the multiplication of the referential price by the factor based on a fixed value (bandwidth). The referential price, which is referred to as the tunnel base price (PBT), is defined as:

- The last traded price, if it is between the best bid and the best ask; or
- The best bid, if it is above the last traded price; or
- The best ask, if it is below the last traded price.

Without prejudice to the aforementioned observation, BM&FBOVESPA may, if necessary, arbitrate the value of the tunnel base price.

In view of this, we provide below an illustration to describe a trading tunnel structure for an instrument.



Based on the liquidity and volatility of a given instrument, this structure, which is composed of rejection tunnels and auction tunnels, may be simplified so as to be composed of only rejection tunnels **or** only auction tunnels. The complete definition of the trading tunnel structure for each instrument group requires the determination of four rejection bandwidth values and two auction bandwidth values, as well as of the selection of the tunnel calculation method. We describe below both the additive and the multiplicative calculation methods.

Calculation method	Rejection Tunnels	Auction tunnel
Multiplicative	$TR_-^{\{bid\}} = PBT \times (1 + BR_-^{\{bid\}})$ $TR_+^{\{bid\}} = PBT \times (1 + BR_+^{\{bid\}})$ $TR_-^{\{ask\}} = PBT \times (1 + BR_-^{\{ask\}})$ $TR_+^{\{ask\}} = PBT \times (1 + BR_+^{\{ask\}})$	$TL_- = PBT \times (1 + BL_-)$ $TL_+ = PBT \times (1 + BL_+)$
Additive	$TR_-^{\{bid\}} = PBT + BR_-^{\{bid\}}$ $TR_+^{\{bid\}} = PBT + BR_+^{\{bid\}}$ $TR_-^{\{ask\}} = PBT + BR_-^{\{ask\}}$ $TR_+^{\{ask\}} = PBT + BR_+^{\{ask\}}$	$TL_- = PBT + BL_-$ $TL_+ = PBT + BL_+$
Additive in basis points	$TR_-^{\{bid\}} = PBT + BR_-^{\{bid\}} / 100$ $TR_+^{\{bid\}} = PBT + BR_+^{\{bid\}} / 100$ $TR_-^{\{ask\}} = PBT + BR_-^{\{ask\}} / 100$ $TR_+^{\{ask\}} = PBT + BR_+^{\{ask\}} / 100$	$TL_- = PBT + BL_- / 100$ $TL_+ = PBT + BL_+ / 100$

where:

- $TR_-^{\{bid\}}$  : = the lower limit of the rejection tunnel for a bid;  
 $TR_+^{\{bid\}}$  = the upper limit of the rejection tunnel for a bid;  
 $TR_-^{\{ask\}}$  = the lower limit of the rejection tunnel for an ask;  
 $TR_+^{\{ask\}}$  = the upper limit of the rejection tunnel for an ask;  
 $BR_-^{\{bid\}}$  = the lower rejection bandwidth for a bid;  
 $BR_+^{\{bid\}}$  = the upper rejection bandwidth for a bid;  
 $BR_-^{\{ask\}}$  = the lower rejection bandwidth for an ask;  
 $BR_+^{\{ask\}}$  = the upper rejection bandwidth for an ask;  
 $PBT$  = the tunnel base price;  
 $TL_-$  = the lower auction tunnel limit;  
 $TL_+$  = the upper auction tunnel limit;  
 $BL_-$  = the lower auction bandwidth;  
 $BL_+$  = the upper auction bandwidth.

### Numerical Example

Suppose that the tunnel base price of a certain instrument is BRL10.00 and the bandwidth values that establish the instrument's trading tunnels through the additive method are defined in accordance with the following table:

Calculation method	Rejection bandwidths	Auction bandwidths
Additive	$BR_-^{bid}$ : -1,50 $BR_+^{bid}$ : +0,50 $BR_-^{ask}$ : -0,50 $BR_+^{ask}$ : +1,50	$BL_-$ : -0.20 $BL_+$ : +0.20

According to the aforementioned methodology, these bandwidths will result in the following lower and upper rejection and auction limits:

Rejection limits	Auction limits
$TR_-^{bid}$ : R\$ 8,50	$TL_-$ : BRL9.80
$TR_+^{bid}$ : R\$ 10,50	
$TR_-^{ask}$ : R\$ 9,50	$TL_+$ : BRL10.20
$TR_+^{ask}$ : R\$ 11,50	

Then, the instrument's trading tunnels are as follows:

- the rejection tunnel for a bid: [BRL8.50; BRL10.50];
- the rejection tunnel for an ask: [BRL9.50; BRL11.50];
- the auction tunnel: [BRL9.80; BRL10.20].

Therefore, only bids whose prices are between BRL8.50 and BRL10.50 will be allowed to be entered into the order book. Analogously, asks will be allowed to be entered into the order book provided that their prices are between BRL9.50 and BRL11.50. If by chance a trade is executed for a price below BRL9.80 or above BRL10.20, the instrument will be automatically submitted to auction.