

VOLATILITY MECHANISMS

LIMIT UP-LIMIT DOWN

Implemented in 2013, Limit Up-Limit Down (LULD) is a market-wide plan to prevent trades in individual securities from occurring outside of specified price bands, while allowing the security to continue to trade. The LULD mechanism helps to reduce extraordinary volatility in electronic markets by temporarily halting a security. It replaced a system of single stock circuit breakers that was in response to the Flash Crash on May 6, 2010. For each security, a Reference Price and Percentage Parameter is used to establish lower and upper bands through which trading will not take place. The first Reference Price is either the opening price or the bid/ask midpoint of the opening quote on the Primary Listing Exchange. After the open, the Reference Price is the arithmetic mean of the trades taken place in the preceding five minute window. A security will enter a Limit State if the National Best

Offer equals the Lower Price Band or the National Best Bid equals the Upper Price Band. A security will exit a Limit State if the entire size of all Limit State Quotations are executed or cancelled within 15 seconds. If a security does not exit a Limit State within 15 seconds, the Primary Exchange will declare a market-wide trading pause that will last for 5 minutes. As outlined below, LULD Price Bands are wider for Tier 1 vs. Tier 2 securities. Because market volatility tends to be naturally higher at the start and end of the day, the Price Bands are doubled during the first 15 and last 25 minutes of the regular trading day for both Tier 1 and Tier 2 securities. For example, a Tier 1 security with a price greater than \$3 has a price band of 5% between 9:45am-3:35pm and 10% between 9:30am-9:45am and 3:35pm-4:00pm.

		Percentage Parameters to Calculate Price Bands ¹								
		9:30 am - 9:45am ET			9:45 am - 3:35pm ET			3:35 pm - 4:00pm ET		
Securities		Less than \$1	Between (& including) \$1 and \$3	Greater than \$3	Less than \$1	Between (& including) \$1 and \$3	Greater than \$3	Less than \$1	Between (& including) \$1 and \$3	Greater than \$3
Tier 1	<ul style="list-style-type: none"> S&P 500 Components Russell 1000 Components ETPs with over \$2 MM notional volume (excluding Leveraged ETPs) 	Lesser of \$0.15 or 75%	40%	10%	Lesser of \$0.15 or 75%	20%	5%	Lesser of \$0.15 or 75%	40%	10%
Tier 2	<ul style="list-style-type: none"> All other NMS Securities (including Leveraged ETPs, but excluding rights & warrants)² 	Lesser of \$0.15 or 75%	40%	20%	Lesser of \$0.15 or 75%	20%	10%	Lesser of \$0.15 or 75%	40%	20%

- The security price used to determine the applicable percentage parameter is based on the closing price on the previous trading day, or, if no closing price exists, the last sale reported to the Consolidated Tape on the previous trading day.
- Percentage parameters for leveraged products are calculated by multiplying the Tier 2 parameters by the leveraged ratio.

MARKET WIDE CIRCUIT BREAKERS

In addition to single-stock circuit breakers, the equity, options and futures exchanges have coordinated procedures for cross-market trading halts in the event of a

severe market price decline. Before 3:25pm, a market-wide 15-minute trading halt may be triggered if the S&P Index declines 7% from the prior day's close price.

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