

STRESS TEST VALUE CALCULATION GUIDE

Hong Kong Exchanges and Clearing Limited
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1. INTRODUCTION

Hong Kong Securities Clearing Company Limited (“HKSCC”) adopts Next Generation stress testing model to determine the Stress Test Value (“STV”) of Clearing Participants’ (“CPs”) portfolios.

The Next Generation stress testing model is developed in accordance with the regulatory requirements and international best practices e.g., CPMI-IOSCO principle for Financial Market Infrastructure. To promote transparency of the model, files containing key risk parameters required for calculating STV (a.k.a., “Stress Testing Risk Parameter Files”, or “STVRPFs”) will be disseminated to all HKSCC’s CPs on a daily basis upon the launch of Next Generation stress testing model.

This document outlines how to use the Stress Testing Risk Parameter Files to calculate the STV of a portfolio for HKSCC clearable instruments in Hong Kong market.

2. STRESS TESTING RISK PARAMETER FILES

2.1 Layouts of Stress Testing Risk Parameter Files

Three Stress Testing Risk Parameter Files¹ (i.e., RPF02, RPF03 and RPF04) will be generated in csv format and can be downloaded by CPs on each business day. The layouts of the 3 files are shown as below:

RPF02:

This file includes instrument price returns based on theoretical correlation break stress scenarios.

¹ The number of scenario types and scenarios, including ongoing changes, are subject to the SFC approval and will be reflected in the STVRPFs accordingly. HKSCC will notify CPs before any change is made in accordance with applicable CCASS rules/operational procedures.

Valuation_DT	24/09/2021										
STV_Corr_Type	1										
STV_Corr_Count	1000										
STV_Corr_CL	0.994										
STV_Corr_Measure	4										
InstrumentID	FieldType	1	2	3	4	5	6	7	8	9	10
2382	141	-0.0268	0	-0.02244	-0.04667	0.019051	-0.0247	0.003488	-0.0212	0.00703	-0.00163
2800	141	-0.01268	0.012824	0.003968	-0.03385	-0.00796	-0.01721	-0.01541	-0.01198	-0.01501	0.020506
388	141	-0.01642	0	0.01151	-0.02625	-0.00079	-0.02397	0	-0.00668	0.007598	0.023035
3988	141	-0.00728	-0.00395	0	-0.02796	-0.00789	-0.01324	0	-0.01577	0.007503	0.021704
5	141	-0.00124	0.025301	-0.00523	-0.03501	0.006974	-0.00274	-0.0027	-0.01336	-0.00525	0.013336
700	141	-0.00638	0.005514	-0.00897	-0.01578	0.022806	-0.00497	-0.03883	-0.01016	-0.0227	0.019131
2382	142	-0.0268	-0.01983	-0.02244	0.02496	-0.01076	-0.02449	0.003488	-0.0212	0.00703	-0.00163
2800	142	-0.01268	0.012824	0.003968	-0.01955	-0.00796	-0.00197	-0.01541	0.005217	0.007091	0.020506
388	142	-0.01642	0	0.050326	-0.02625	-0.00079	-0.02397	-0.00932	-0.00668	0.007598	0.023035
3988	142	0.004984	-0.00395	-0.0068	-0.02796	-0.00199	-0.01324	0.004373	-0.01577	0.007503	0.021704
5	142	-0.00124	0.025301	-0.00523	-0.03501	0.006974	-0.00274	-0.0027	-0.01336	-0.00525	0.002292
700	142	-0.00638	0.005514	-0.00897	-0.00351	-0.04405	0.007144	-0.03883	-0.01016	-0.0227	0.019131
2382	143	0.002143	-0.01983	-0.02244	0.02496	-0.01076	-0.02449	0.003488	-0.0212	0.00703	-0.00163
2800	143	0.008037	0.012824	0.003968	-0.01955	-0.00796	-0.00197	-0.00319	0.005217	0.007091	0.005865
388	143	-0.01642	0	0.050326	-0.02625	-0.00079	0.006326	-0.00932	-0.00668	0.035388	-0.044
3988	143	0.004984	-0.00395	-0.0068	-0.00229	-0.00199	-0.01324	0.004373	-0.00472	0.007503	0.021704
5	143	-0.00359	0.025301	-0.00523	0	0.006974	-0.00274	0.018829	-0.01336	0.001053	0.002292
700	143	-0.00473	0.005514	-0.00897	-0.00351	-0.04405	0.007144	-0.03883	-0.01016	-0.0227	-0.00387
2382	144	0.002143	-0.01983	-0.02244	0.02496	-0.01076	-0.02449	-0.00733	-0.01048	0.00703	-0.04682
2800	144	0.008037	0.007288	0.007911	-0.01955	-0.00796	-0.00197	-0.00319	0.005217	0.007091	0.005865
388	144	0.004546	-0.01744	0.050326	0.017996	0.006496	0.006326	-0.00932	-0.02229	0.035388	-0.044
3988	144	0.004984	-0.00395	-0.0068	-0.00229	-0.00199	-0.01324	0.004373	-0.00472	0.007503	0.00729
5	144	-0.00359	-0.00102	-0.00834	0	0.003942	0.009723	0.018829	-0.00208	0.001053	0.002292
700	144	-0.00473	0.005514	-0.00857	-0.00351	-0.04405	0.007144	-0.01074	0.006544	-0.03527	-0.00387

RPF03:

This file includes instrument price returns based on theoretical correlation boost stress scenarios.

Valuation_DT	24/09/2021											
STV_Corr_Type	2											
STV_Corr_Count	1000											
STV_Corr_CL	0.994											
STV_Corr_Measure	4											
InstrumentID	FieldType	1	2	3	4	5	6	7	8	9	10	
2382	151	-0.0268	0	0.0097	-0.04667	0.019051	-0.0247	0.003488	-0.0212	-0.03092	-0.00163	
2800	151	-0.01268	0.012824	0.003968	-0.03385	0.010266	-0.01721	-0.01541	-0.01198	-0.01501	0.020506	
388	151	-0.01642	0	0.01151	-0.02625	-0.00079	-0.02397	0	-0.00668	0.007598	0.023035	
3988	151	-0.00728	0.007981	0	-0.02796	-0.00789	-0.01026	0	-0.01577	-0.01067	0.021704	
5	151	-0.00124	0.025301	-0.00523	-0.03501	0.006974	-0.00274	-0.0027	-0.01336	-0.00525	0.013336	
700	151	-0.00638	0.025948	-0.00897	-0.01578	0.022806	-0.00497	-0.03883	-0.01016	-0.0227	0.019131	
2382	152	-0.0268	0.023129	0.0097	-0.06747	0.020846	-0.02974	0.003488	-0.0212	-0.03092	-0.00163	
2800	152	-0.01268	0.012824	0.003968	-0.03323	0.010266	-0.01465	-0.01541	-0.01224	-0.01523	0.020506	
388	152	-0.01642	0	0.007236	-0.02625	-0.00079	-0.02397	-0.02832	-0.00668	0.007598	0.023035	
3988	152	-0.00873	0.007981	0.003347	-0.02796	0.007193	-0.01026	-0.0131	-0.01577	-0.01067	0.021704	
5	152	-0.00124	0.025301	-0.00523	-0.03501	0.006974	-0.00274	-0.0027	-0.01336	-0.00525	0.01753	
700	152	-0.00638	0.025948	-0.00897	-0.0757	0.023386	-0.03337	-0.03883	-0.01016	-0.0227	0.019131	
2382	153	-0.02529	0.023129	0.0097	-0.06747	0.020846	-0.02974	0.003488	-0.0212	-0.03092	-0.00163	
2800	153	-0.01246	0.012824	0.003968	-0.03323	0.010266	-0.01465	-0.0187	-0.01224	-0.01523	0.0197	
388	153	-0.01642	0	0.007236	-0.02625	-0.00079	-0.02219	-0.02832	-0.00668	-0.02306	0.029838	
3988	153	-0.00873	0.007981	0.003347	-0.02328	0.007193	-0.01026	-0.0131	-0.00857	-0.01067	0.021704	
5	153	-0.01108	0.025301	-0.00523	-0.02957	0.006974	-0.00274	-0.01664	-0.01336	-0.01355	0.01753	
700	153	-0.02837	0.025948	-0.00897	-0.0757	0.023386	-0.03337	-0.03883	-0.01016	-0.0227	0.044875	
2382	154	-0.02529	0.023129	0.0097	-0.06747	0.020846	-0.02974	-0.03797	-0.02485	-0.03092	0.040001	
2800	154	-0.01246	0.011391	0.004777	-0.03323	0.010266	-0.01465	-0.0187	-0.01224	-0.01523	0.0197	
388	154	-0.01887	0.017253	0.007236	-0.05033	0.015549	-0.02219	-0.02832	-0.01854	-0.02306	0.029838	
3988	154	-0.00873	0.007981	0.003347	-0.02328	0.007193	-0.01026	-0.0131	-0.00857	-0.01067	0.013802	
5	154	-0.01108	0.010136	0.004251	-0.02957	0.009135	-0.01303	-0.01664	-0.01089	-0.01355	0.01753	
700	154	-0.02837	0.025948	0.010882	-0.0757	0.023386	-0.03337	-0.0426	-0.02788	-0.03468	0.044875	

RPF04:

This file includes instrument price returns based on all other stress scenarios (i.e., historical stress scenarios, hypothetical macroeconomic stress scenarios, idiosyncratic stress scenarios and flat rate stress scenarios).

Valuation_DT	27/09/2021											
Hist_Scen_Count	254											
Hypo_Scen_Count	24											
Idio_Scen_Count	2											
CA_Count	2120											
Hist_Special_Scen	1	2	3	4	5	6	7	8	9	10		
InstrumentID	FieldType	1	2	3	4	5	6	7	8	9	10	
2382	111	-0.34902	-0.34902	-0.34902	-0.34902	-0.34902	-0.34902	-0.34902	-0.34902	-0.34902	-0.34902	-0.34902
2800	111	-0.22	-0.22	-0.22	-0.22	-0.22	-0.22	-0.22	-0.22	-0.22	-0.22	-0.22
388	111	-0.24616	-0.24616	-0.24616	-0.24616	-0.24616	-0.24616	-0.24616	-0.24616	-0.24616	-0.24616	-0.24616
3988	111	-0.22118	-0.22118	-0.22118	-0.22118	-0.22118	-0.22118	-0.22118	-0.22118	-0.22118	-0.22118	-0.22118
5	111	-0.00847	0	-0.15385	0.040404	0.019417	0.047619	0.045455	-0.02609	0.008929	-0.0177	
700	111	-0.22074	-0.22074	-0.22074	-0.22074	-0.22074	-0.22074	-0.22074	-0.22074	-0.22074	-0.22074	-0.22074
2382	121	-0.04877	0.18295	0.18295	0.013576	0.005555	0.020621	0.04877	-0.18295	-0.18295	-0.01358	
2800	121	-0.02316	0.041111	0.027774	0.001502	0.018505	0.026238	0.023165	-0.04111	-0.02777	-0.0015	
388	121	-0.0095	0.034252	0.022351	-0.00574	0.034798	0.086124	0.009502	-0.03425	-0.02235	0.005742	
3988	121	-0.0044	0.015857	0.010347	-0.00266	0.016109	0.03987	0.004399	-0.01586	-0.01035	0.002658	
5	121	-0.00564	0.020316	0.013257	-0.00341	0.020639	0.051082	0.005636	-0.02032	-0.01326	0.003405	
700	121	-0.08971	0.111787	0.062607	-0.02303	-0.00398	0.01048	0.089705	-0.11179	-0.06261	0.02303	
2382	131	-0.4	0.4									
388	131	-0.4	0.4									
3988	131	-0.4	0.4									
5	131	-0.4	0.4									
700	131	-0.4	0.4									
2800	132	-1	1									
DIV5	161	-0.3	0.3									
DSP700	161	-0.5	0.5									
SRI2382	161	-0.5	0.5									
1012	161	-0.22	0.22									
1054	161	-1	1									

2.2 Specifications of Stress Testing Risk Parameter Files

Field Name	Description	Format
Valuation_DT	Valuation date	DD/MM/YYYY
STV_Corr_Type	Type of theoretical stress scenarios	1 – Theoretical correlation boost scenarios 2 – Theoretical correlation break scenarios
STV_Corr_Count	Number of theoretical correlation break and boost stress scenarios	INTEGER (X,0) ² ; e.g. 1,000 means 1,000 theoretical correlation break and 1,000 correlation boost scenarios
STV_Corr_CL	Confidence level of theoretical correlation break and boost stress scenarios	DECIMALS (X,10) ² ; e.g. 0.994
STV_Corr_Measure	Risk measure type of theoretical correlation break and boost stress scenarios	4 – FHS ES (Discrete) ³
Hist_Scen_Count	Number of historical stress scenarios	INTEGER (X,0); e.g. 280
Hypo_Scen_Count	Number of hypothetical macroeconomic stress scenarios	INTEGER (X,0); e.g. 60
Idio_Scen_Count	Number of idiosyncratic stress scenarios	INTEGER (X,0); e.g. 2
CA_Count	Number of Corporate action (“CA”) scenarios	INTEGER (X,0); e.g. 2
Hist_Special_Scen	Scenario number of historical stress scenarios subject to a special fallback calculation	INTEGER (X,0); e.g., 1
InstrumentID	Instrument identifier for HKSCC products	TEXT
FieldType	Type of stress scenarios	111 - Historical stress scenarios 121 - Hypothetical macroeconomic stress scenarios 141 - 144 Theoretical correlation break scenarios 151 - 154 Theoretical correlation boost scenarios 131 - Idiosyncratic stress scenarios 161 - Flat rate stress scenarios
Numbers next to FieldType	Scenario numbers	INTERGER (X,0); e.g. 1
RiskScen (values under each scenario)	% return scenarios for various FieldTypes	DECIMALS (X,10); e.g. 0.222 means 22.2%

3. CALCULATION OF STRESS TEST VALUE (“STV”)

3.1 Required Inputs

3.1.1 Risk Parameters

All required risk parameters are included in the Stress Testing Risk Parameter Files as described in §2, which will be disseminated to CPs on a daily basis.

² The second number in INTEGER() and DECIMALS() refers to the maximum decimal places supported by STVRPFs.

³ FHS ES stands for Filtered Historical Simulation Expected Shortfall, also known as Conditional Value-at-Risk (“CVaR”) or Expected Tail Loss (“ETL”) or average tail loss. It is the risk measure calculated based on Exponential Weighted Moving Average (“EWMA”) rescaled historical returns in the look-back period. “Discrete” means only discrete data points on the distribution tail will be selected for calculation. There is no interpolation required between discrete data points.

3.1.2 Positions

The following position details of portfolios are required to calculate STV:

- InstrumentID (e.g., 5 for HSBC Holdings)
- Quantity⁴ (e.g., -400 means to deliver 400 shares)
- Market value⁵ in HKD equivalent

A sample portfolio is shown for illustration purpose as follows:

InstrumentId	Quantity	Contract value in HKD Equivalent	Market value in HKD Equivalent
5	1,100	60,000	65,000
388	-110	-27,000	-27,500
700	200	60,000	35,000
2382	-120	-14,000	-14,000
2800	3,000	78,000	75,000
3988	11,900	38,000	37,000
DIV5	0	-1,100	0
DSP700	50	0	1,000
SRI2382	-20	0	-500
1012	-4,000	-4,400	-4,000
1054	100,000	1,200	1,000

3.2 Calculation Process

3.2.1 Overview of the Calculation Process for STV

STV is calculated based on the returns of stress scenarios in Stress Testing Risk Parameter Files and the positions of portfolios according to the steps as follows:

- Identify applicable stress scenario type for each instrument in portfolio (See §3.2.2);
- Calculate STV for scenario based positions (See §3.2.3);
- Calculate STV returns for flat rate positions (See §3.2.4); and
- Calculate the STV of the portfolio (See §3.2.5).

3.2.2 Identify applicable stress scenario type for each instrument in portfolio

Users shall identify applicable stress scenario type by using the “Stress Testing Risk Parameter Files” according to the steps as follows:

Step 1: Identify all corresponding FieldType(s) in the “Stress Testing Risk Parameter Files” for each instrument

For example, Instrument Code 388, users shall find out “388” under the column InstrumentId and identify the corresponding FieldType(s) associated with the instrument in the “Stress Testing Risk Parameter Files”. In this case, FieldTypes 141, 142, 143 and 144 are identified for the instruments in RPF02. FieldTypes 151, 152, 153 and 154 are identified for the instruments in RPF03. FieldTypes 111, 121, 131 and 161 are identified for the instruments in RPF04.

⁴ Positive values refer to long positions. Negative values refer to short positions.

⁵ Market value = Position quantity x Instrument market price. The sign is determined by the position quantity. (i.e., Negative quantity means a short position and that market value is also negative.)

After repeating the aforementioned step for each instrument, the identification result of the sample portfolio is shown as follows:

Instrument Code / InstrumentId	Scenario based stress scenario types											
	Correlation break stress				Correlation boost stress				Historical stress	Macroeconomic stress	Idiosyncratic stress	Flat rate stress
	RPF02				RPF03				RPF04			
	FieldType											
	141	142	143	144	151	152	153	154	111	121	131 or 132	161
5	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	-
388	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	-
700	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	-
2382	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	-
2800	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	-
3988	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	-
DIV5	-	-	-	-	-	-	-	-	-	-	-	Y
DSP700	-	-	-	-	-	-	-	-	-	-	-	Y
SRI2382	-	-	-	-	-	-	-	-	-	-	-	Y
1012	-	-	-	-	-	-	-	-	-	-	-	Y
1054	-	-	-	-	-	-	-	-	-	-	-	Y

3.2.3 Calculate STV for scenario based positions

3.2.3.1 Correlation Break Stress Scenarios

STV of correlation break stress scenarios is calculated according to the steps as follows:

Step 1: Calculate the portfolio return of positions in each scenario under FieldType 141 identified as per instructions in §3.2.2.

For example:

$$\begin{aligned}
 &\text{Portfolio return}^6 \text{ in scenario 1} \\
 &= (\text{Market Value}_5 \times \text{Return}_5) + (\text{Market Value}_{388} \times \text{Return}_{388}) + (\text{Market Value}_{700} \times \text{Return}_{700}) \\
 &+ (\text{Market Value}_{2382} \times \text{Return}_{2382}) + (\text{Market Value}_{2800} \times \text{Return}_{2800}) + (\text{Market Value}_{3988} \times \text{Return}_{3988}) \\
 &= (65,000 \times -0.00124) + (-27,500 \times -0.01642) + (35,000 \times -0.00638) + (-14,000 \times -0.0268) \\
 &+ (75,000 \times -0.01268) + (37,000 \times -0.00728) \\
 &= -698
 \end{aligned}$$

⁶ Round off to the nearest integer if the result is a decimal number.

Step 2: Repeat step 1 for all 1000 (referring to STV_Corr_Count in the Stress Testing Risk Parameter Files) scenarios under FieldType 141.

A set of scenario returns under FieldType 141 will be obtained as follows:

	Scenario 1	Scenario 2	...	Scenario 1,000
Portfolio return under FieldType 141	-698	2,653	...	-347

Step 3: Repeat steps 1 and 2 for all scenarios under FieldTypes 142, 143 and 144

	Scenario 1	Scenario 2	...	Scenario 1,000
Portfolio return under FieldType 141	-698	2653	...	-347
Portfolio return under FieldType 142	-244	2930	...	474
Portfolio return under FieldType 143	810	2930	...	1911
Portfolio return under FieldType 144	233	1284	...	2703

Step 4: Calculate Correlation break stress of the portfolios by averaging the worst 6 scenarios⁷.

	Scenario 1	...	Scenario 1,000	Average of worst 6 scenarios
Portfolio return under FieldType 141	-698	...	-347	-8,451.1667
Portfolio return under FieldType 142	-244	...	474	-8,056.6667
Portfolio return under FieldType 143	810	...	1911	-7,059.3333
Portfolio return under FieldType 144	233	...	2703	-5,831.8333

3.2.3.2 Correlation Boost Stress Scenarios

The STV of correlation boost stress scenarios is calculated according to the steps as follows:

Step 1: Calculate the portfolio return of positions in each scenario under FieldType 151 identified as per instructions in §3.2.2.

For example:

$$\begin{aligned} & \text{Portfolio return}^8 \text{ in scenario 1} \\ &= (\text{Market Value}_5 \times \text{Return}_5) + (\text{Market Value}_{388} \times \text{Return}_{388}) + (\text{Market Value}_{700} \times \text{Return}_{700}) \\ &+ (\text{Market Value}_{2382} \times \text{Return}_{2382}) + (\text{Market Value}_{2800} \times \text{Return}_{2800}) + (\text{Market Value}_{3988} \times \text{Return}_{3988}) \end{aligned}$$

$$\begin{aligned} &= (65,000 \times -0.00124) + (-27,500 \times -0.01642) + (35,000 \times -0.00638) + (-14,000 \times -0.0268) \\ &+ (75,000 \times -0.01268) + (37,000 \times -0.00728) \end{aligned}$$

⁷ (1-99.4% (STV_Corr_CL)) x 1000 (STV_Corr_Count) scenarios = 6 scenarios, rounding up to the nearest integer. The confidence level as well as ongoing changes (if any) are subject to the SFC approval.

⁸ Round off to the nearest integer if the result is a decimal number.

= -698

Step 2: Repeat step 1 for all 1000 (referring to STV_Corr_Count in the Stress Testing Risk Parameter Files) scenarios under FieldType 151.

A set of scenario returns under FieldType 151 will be obtained as follows:

	Scenario 1	Scenario 2	...	Scenario 1,000
Portfolio return under FieldType 151	-698	3,810	...	-2,149

Step 3: Repeat steps 1 and 2 for all scenarios under FieldTypes 152, 153 and 154

	Scenario 1	Scenario 2	...	Scenario 1,000
Portfolio return under FieldType 151	-698	3,810	...	-2,149
Portfolio return under FieldType 152	-751	3,486	...	-2,172
Portfolio return under FieldType 153	-2,165	3,486	...	-2,073
Portfolio return under FieldType 154	-2,098	1,919	...	-1,445

Step 4: Calculate correlation boost stress of the portfolios by averaging the worst 6 scenarios⁹.

	Scenario 1	...	Scenario 1,000	Average of worst 6 scenarios
Portfolio return under FieldType 151	-698	...	-2,149	-8,099.6667
Portfolio return under FieldType 152	-751	...	-2,172	-7,886.1667
Portfolio return under FieldType 153	-2,165	...	-2,073	-8,095.6667
Portfolio return under FieldType 154	-2,098	...	-1,445	-8,838.3333

3.2.3.3 Historical Stress Scenarios

The STV of historical stress scenarios is calculated according to the steps as follows:

Step 1: Calculate the portfolio return of positions in each scenario under FieldType 111 identified as per instructions in §3.2.2.

If the scenarios number is on the list under “Hist_Special_Scen”, then calculate the portfolio scenario return as below:

For example:

Divide the portfolio into a long positions sub-portfolio and a short positions sub-portfolio.

Long position sub-portfolio return in scenario 1

⁹ (1-99.4% (STV_Corr_CL)) x 1000 (STV_Corr_Count) scenarios = 6 scenarios, rounding up to the nearest integer. The change of the confidence level is subject to the SFC approval.

$$\begin{aligned}
 &= - \text{Absolute value of (Market Value}_5 \times \text{Return}_5) - \text{Absolute value of (Market Value}_{700} \times \text{Return}_{700}) - \text{Absolute value of (Market Value}_{2800} \times \text{Return}_{2800}) - \text{Absolute value of (Market Value}_{3988} \times \text{Return}_{3988}) \\
 &= - \text{Absolute value of (65,000} \times -0.00847) - \text{Absolute value of (35,000} \times -0.22074) - \text{Absolute value of (75,000} \times -0.22) - \text{Absolute value of (37,000} \times -0.22118) \\
 &= -32,960.11
 \end{aligned}$$

Short position sub-portfolio return in scenario 1

$$\begin{aligned}
 &= - \text{Absolute value of (Market Value}_{388} \times \text{Return}_{388}) - \text{Absolute value of (Market Value}_{2382} \times \text{Return}_{2382}) \\
 &= - \text{Absolute value of (-27,500} \times -0.24616) - \text{Absolute value of (-14,000} \times -0.34902) \\
 &= -11,655.68
 \end{aligned}$$

Portfolio return¹⁰ in scenario 1
= Minimum (Long position sub-portfolio return in scenario 1, Short position sub-portfolio return in scenario 1)

$$= \text{Minimum (-32,960.11, -11,655.68)}$$

$$= -32,960$$

If the scenarios number is not on the list under “Hist_Special_Scen”, then calculate the portfolio scenario return as below:

For example:

Portfolio return¹¹ in scenario 1

$$\begin{aligned}
 &= (\text{Market Value}_5 \times \text{Return}_5) + (\text{Market Value}_{388} \times \text{Return}_{388}) + (\text{Market Value}_{700} \times \text{Return}_{700}) + (\text{Market Value}_{2382} \times \text{Return}_{2382}) + (\text{Market Value}_{2800} \times \text{Return}_{2800}) + (\text{Market Value}_{3988} \times \text{Return}_{3988})
 \end{aligned}$$

$$\begin{aligned}
 &= (65,000 \times -0.00847) + (-27,500 \times -0.24616) + (35,000 \times -0.22074) + (-14,000 \times -0.34902) + (75,000 \times -0.22) + (37,000 \times -0.22118)
 \end{aligned}$$

$$= -21,304$$

Step 2: Repeat step 1 for all 280 (referring to Hist_Scen_Count in the Stress Testing Risk Parameter Files) scenarios under FieldType 111.

A set of scenario returns under FieldType 111 will be obtained as follows:

	Scenario 1	Scenario 2	...	Scenario 280
Portfolio return under FieldType 111	-32,960	-32,410	...	1,602

Step 3: Take the portfolio return of the worst scenario as the historical stress of the portfolios.

	Scenario 1	...	Scenario 280	The worst scenario
Portfolio return under FieldType 111	-32,960	...	1,602	-42,410

¹⁰ Round off to the nearest integer if the result is a decimal number.

¹¹ Round off to the nearest integer if the result is a decimal number.

3.2.3.4 Macroeconomic Stress Scenarios

The STV of macroeconomic stress scenarios is calculated according to the steps as follows:

Step 1: Calculate the portfolio return of positions in each scenario under FieldType 121 identified as per instructions in §3.2.2.

For example:

$$\begin{aligned} & \text{Portfolio return}^{12} \text{ in scenario 1} \\ & = (\text{Market Value}_5 \times \text{Return}_5) + (\text{Market Value}_{388} \times \text{Return}_{388}) + (\text{Market Value}_{700} \times \text{Return}_{700}) \\ & \quad + (\text{Market Value}_{2382} \times \text{Return}_{2382}) + (\text{Market Value}_{3988} \times \text{Return}_{3988}) \\ & = (65,000 \times 0.06195) + (-27,500 \times -0.08604) + (35,000 \times 0.12999) + (-14,000 \times 0.1847) \\ & \quad + (75,000 \times 0.0695) + (37,000 \times 0.04322) \\ & = 10,436 \end{aligned}$$

Step 2: Repeat step 1 for all 102 (referring to Hypo_Scen_Count in the Stress Testing Risk Parameter Files) scenarios under FieldType 121.

A set of scenario returns under FieldType 121 will be obtained as follows:

	Scenario 1	Scenario 2	...	Scenario 102
Portfolio return under FieldType 121	10,436	-6,958	...	5,678

Step 3: Take the return for the worst scenario as the macroeconomic stress of the portfolios.

	Scenario 1	...	Scenario 102	The worst scenario
Portfolio return under FieldType 121	-5,813	...	5,678	-17,018

3.2.3.5 Idiosyncratic Stress Scenarios

The STV of idiosyncratic stress scenarios is calculated according to the steps as follows:

Step 1: Rank and count the market value in HKD equivalent of each position identified under FieldType 131 or 132 as per instructions in §3.2.2.

- Rank quantity > 0 in descending order and count the total number of positions; and
- Rank quantity < 0 in ascending order and count the total number of positions.

	InstrumentId	Quantity	Market value in HKD equivalent	Rank	FieldType
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¹² Round off to the nearest integer if the result is a decimal number.

Quantity > 0	2800	3,000	75,000	1	132
	5	1,100	65,000	2	131
	3988	11,900	37,000	3	131
	700	200	35,000	4	131
Total number of positions with Quantity > 0					4
Quantity < 0	388	-110	-27,500	1	131
	2382	-120	-14,000	2	131
Total number of positions with Quantity < 0					2

Step 2: Select the top 1%¹³ (rounding up to nearest integer) positions to calculate idiosyncratic stress.

For the positions with Quantity > 0, the required number of positions = 4 x 1%
= 1

For the positions with Quantity < 0, the required number of positions = 2 x 1%
= 1

If the selected instrument is under FieldType 132, it should be excluded from top position selection to apply the idiosyncratic stress.

i.e., in the example, position of 2800 is excluded and position of 5 will be included and selected as top 1% positions.

	InstrumentId	Quantity	Market value in HKD equivalent	Rank	FieldType
Quantity > 0	5	1,100	65,000	2	131
Quantity < 0	388	-110	-27,500	1	131

Step 3: Calculate idiosyncratic stress of the portfolios by taking the worst scenario return for positions with Quantity > 0 and positions with Quantity < 0

- For each long position with Quantity > 0, apply Scenario 1 return; and
- For each short position with Quantity < 0, apply Scenario 2 return.

i.e.,

	InstrumentId	Market value in HKD equivalent	Scenario 1 return	Scenario 2 return	The worst scenario
Quantity > 0	5	65,000	-26,000	-	
Quantity < 0	388	-27,500	-	-11,000	
Portfolio return under FieldType 131			-26,000	-11,000	-26,000

3.2.4 Calculate STV for flat rate positions

3.2.4.1 Gross flat rate stress scenarios

Corporate Action positions which the first three characters of the instrument ID are either “DIV”, “SRI” or “DSP” followed by the announcement stock code would be subject to gross flat rate stress.

¹³ The change of the percentage is subject to the SFC approval. HKSCC will issue circulars to notify the market before any change is made.

The STV of gross flat rate stress scenarios is calculated according to the steps as follows:

Step 1: Calculate the net market value of corporate action positions for each scenario under FieldType 161 identified as per instructions in §3.2.2.

The result of the sample portfolio is shown as follows:

InstrumentId	Quantity	Contract value in HKD equivalent (A)	Market value in HKD equivalent (B)	Net market value (C) = (B) - (A)
DIV5	= 0	-1,100	0	1,100
DSP700	> 0	0	1,000	1,000
SRI2382	< 0	0	-500	-500

Step 2: Apply positive net market value positions to scenario 1 under FieldType 161.

Step 3: Apply negative net market value positions to scenario 2 under FieldType 161.

Step 4: Add the results obtained from steps 2 and 3.

Portfolio return¹⁴

$$= (\text{net market value}_{\text{DIV5}}) \times \text{scenario 1} + (\text{net market value}_{\text{DSP700}}) \times \text{scenario 1} + (\text{net market value}_{\text{SRI2382}}) \times \text{scenario 2}$$

$$= (1,100) \times (-0.3) + (1,000) \times (-0.5) + (-500) \times (0.5)$$

$$= -1,080$$

3.2.4.2 Net flat rate stress scenarios

The STV of net flat rates stress scenarios is calculated according to the steps as follows:

Step 1: For each position other than corporate action positions having positive market value under FieldType 161, apply scenario 1

Step 2: For each position other than corporate action positions having negative market value under FieldType 161, apply scenario 2

Step 3: Take the worse results obtained from steps 2 and 3.

Portfolio return¹⁵

$$= \text{Minimum}((\text{Market value}_{1054}) \times \text{scenario 1}, (\text{Market value}_{1012}) \times \text{scenario 2})$$

$$= \text{MIN}((1,000) \times (-1), (-4,000) \times (0.22))$$

$$= -1,000$$

3.2.5 Calculate the STV of the Portfolio

The STV is the sum of:

¹⁴ Round off to the nearest integer if the result is a decimal number.

¹⁵ Round off to the nearest integer if the result is a decimal number.

- (i) Absolute value of the worst portfolio return among different scenario base stress testing scenarios; and
- (ii) Absolute value of the flat rate positions stress return.

STV of the portfolio

= Absolute value of [Minimum (STV of correlation break stress scenarios, STV of correlation boost stress scenarios, STV of historical stress scenarios, STV of macroeconomic stress scenarios, STV of idiosyncratic stress scenarios)] + Absolute value of (Portfolio return in flat rate stress scenarios)

= Absolute value of [Minimum (-8,451.1667 , -8,838.3333 , -42,410 , -17,018 , -26,000)] + Absolute value of [(-1,080) + (-1,000)]

= 46,651 (rounding up to the nearest integer) + 2,080

= **48,731**

4. APPENDIX

4.1 Expected Uncollateralised Loss (“EUL”)

The HKSCC default fund resizing would be based on the EUL of the clearing participants as per the predetermined default assumption.

EUL in Hong Kong market

= Stress Test Value_{HK} + realized portfolio profit/loss - Collateral on hand_{HK} - Margin Credit utilized + (Liquidation risk add-on + Structured product add-on)¹⁶

EUL in China markets

= Stress Test Value_{CN}¹⁷ - Collateral on hand_{CN}¹⁸

Overall EUL

= MAX(EUL in Hong Kong market,0) + MAX(EUL in China market,0)

¹⁶ CP can refer to the MTM and Margin Requirement Report (“RMAMR01”) for the margin add-on components

¹⁷ It is calculated as described in Section 3.2.4.2 by using the China markets positions of the CP

¹⁸ Mainland Settlement Deposit and Mainland Security Deposit