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MAY 2016

**Statement of Guidance  
for Licensees seeking approval to use an Internal Capital Model  
("ICM") to calculate the Prescribed Capital Requirement ("PCR")**



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## **1 Statement of Objectives**

- 1.1 This guidance sets out the criteria that the Authority will use for determining whether or not to grant approval to a licensee to use an Internal Capital Model (“ICM”) to calculate the Prescribed Capital Requirement (“PCR”). This guidance should be read in conjunction with the ‘Regulatory Procedure - Submission process for Internal Capital Models (“Regulatory Procedure”)’.
- 1.2 This guidance applies to licensees under the Insurance Law, 2010 that are eligible as per the laws and regulations to seek approval to use an ICM to calculate the PCR (hereafter referred to as “Licensee”).

## **2 Introduction**

- 2.1 This Statement of Guidance contains general guidance that Licensees must follow when seeking approval from the Authority to use an ICM to calculate the PCR.
- 2.2 This guidance is designed to assist the Licensee in meeting with the Authority’s expectations for an ICM. The Authority will not approve an ICM unless it is satisfied that the model is central to a licensee’s decision making processes and is embedded in its operations.
- 2.3 The ICM should be appropriate to the nature, scale and complexity of the Licensee and the risks to which the Licensee is exposed.
- 2.4 This guidance specifically covers the following areas:
  - a. Use Test
  - b. Statistical Quality Tests
  - c. Calibration
  - d. Stress and Scenario Tests
  - e. Validation
  - f. Documentation
  - g. Model Governance
  - h. Internal Controls
  - i. Risk Assessment
- 2.5 A glossary is located in Schedule 1 of this guidance.



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### 3 Use Test

#### Purpose

An ICM should be central to a Licensee’s decision making process and be fully embedded within its operations. This is referred to as the “use test” and requires that the Licensee shows that its ICM is widely used throughout its organization and serves as a critical input into corporate governance, particularly as it relates to the risk management framework and the development, implementation and monitoring of management strategies.

#### General Guidance

- 3.1 The ICM, its methodologies and results, should be fully embedded within the Licensee’s risk strategy and operational processes. The ICM should assist in the measurement and management of material sources of risk and be used to evaluate potential actions to mitigate unsatisfactory risk exposures. The ICM should also be used by the Licensee to better understand the alignment of exposures (e.g. the interaction, correlation or diversification between risks) across different risk categories.
- 3.2 The ICM should produce information that is sufficiently current and up-to-date. The information should also be at the appropriate level of detail required for decision making.
- 3.3 In addition to the evaluation of capital adequacy, the Authority will consider whether an ICM is used by the Licensee for its own risk and capital management. Examples may include but are not limited to:
  - a. allocation of capital to risk categories, business segments and lines of business;
  - b. profit and loss attribution;
  - c. design and evaluation of risk appetite;
  - d. management of risk limits and portfolio composition;
  - e. assessment of outward reinsurance strategies;
  - f. development and evaluation of business plans, including new lines of business or new areas of risk;
  - g. capital management;
  - h. determination of investment policies and strategies, including hedging;
  - i. management actions to be applied in the business;



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- j. strategic considerations such as M&A and divestitures; and
  - k. objective setting and performance assessment.
- 3.4 The ICM should contain processes and reporting that enables the Licensee to monitor, manage and report on the individual and aggregate risks to which the Licensee is or could be exposed, as well as the interactions and dependencies between risks.
- 3.5 A broad involvement of a range of business functions should exist in the use of the ICM, including both executive management and risk management. Each business function should understand how its areas of responsibility are reflected in the ICM and how past experience will impact capital requirements.
- 3.6 There should be an adequate recognition of the limitations of modelling processes, given the range of factors considered in management's decision making processes and the inherent limitations of ICM. The Authority would expect the ICM to be used as an input in to key management decisions; however, the ICM should not be the sole determinant of such decisions.
- 3.7 The frequency of determination of the PCR using the ICM should be consistent with the Licensee's needs, but it must be assessed at least annually. The Board and management should also ensure that processes are in place to update the ICM to take into account changes in the Licensee's risk strategy or other business changes or external changes.
- 3.8 The Licensee's Board and management should have overall control of and responsibility for the construction and use of the ICM for risk management purposes in order to ensure full embedding of the model within the Licensee's risk and capital management processes and operational procedures. The methodology used in building the model should be compatible with the overall risk management framework agreed to by the Board and management.
- 3.9 All departments of the Licensee should use and entirely consider the ICM. The ICM should be fully embedded within the organization which results in continuous feedback to the modelling team on the reasonableness of its results and the validity of the model inputs and critical assumptions. The frequency of feedback will vary from one licensee to another.
- 3.10 The Licensee should have detailed formal policies and procedures governing model use. These may include policies regarding ICM data, security, ownership, change, and validation.
- 3.11 The Licensee should be in a position to discuss with both the Board and the Authority the capital requirement estimated by the ICM. This should include a discussion by risk category.



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3.12 In addition, the Authority expects the Licensee to have appropriate governance and internal controls in place with respect to the ICM.



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## 4 Statistical Quality Test

### Purpose

Statistical Quality Tests examine the appropriateness of the underlying data used in the ICM. This includes examination of:

- the aggregation of data;
- the modelling assumptions utilized;
- the statistical measures used in the ICM; and
- whether the ICM reflects all reasonably foreseeable and relevant material risks

### General Guidance

- 4.1 The ICM needs to be sufficiently comprehensive to include all material risks to enable the Authority to form a well-rounded view of the Licensee's financial condition and performance, business activities, and the risks related to those activities. Materiality is defined by the Licensee and is subject to review by the Authority.
- 4.2 The Licensee should perform a review of the ICM to determine whether the assets and liability portfolios as represented in the model reflect the nature of the risks associated with these assets and liabilities. The model should allow for any financial guarantees and embedded options.
- 4.3 The statistical quality tests are to be performed on an annual basis or more frequently as required by changes in risks and assumptions. Prior period data should be scrutinized to determine whether the data continues to be relevant.
- 4.4 If the Licensee has established its ICM to assess risks at a modular level, i.e. on a risk-by-risk basis, the results for each of these risks should be aggregated both within and across the business.
- 4.5 The modelling approaches and methodologies used in the ICM should be appropriate to the nature, scale and complexity of the Licensee and the risks to which the Licensee is exposed. The Licensee should ensure that the ICM includes the scenarios that are most appropriate to its business and be able to demonstrate and explain why they are appropriate.
- 4.6 The techniques used in the ICM should be based on rigorous actuarial and statistical techniques and be consistent with the methods of the Licensee's internal business processes.



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There are several different techniques that are considered appropriate (e.g. deterministic scenarios vs. stochastic modelling), and the Licensee should select the technique or techniques considered to be most appropriate based upon the Licensee's evaluation of its underlying risk exposures. The techniques selected are subject to review by the Authority.

- 4.7 Dependencies within and among risk categories or drivers should be adequately considered in the ICM. The Licensee should justify diversification benefits between risk categories and provide comprehensive descriptions of the material assumptions and methodologies underlying aggregation and any dependency structures in the ICM. Additionally the Licensee should demonstrate that the ICM adequately captures interactions and dependencies between risks in extreme scenarios, or tail events, including the effect of the Licensee's hedging strategies and collateral requirements upon these extreme scenarios.
- 4.8 The Licensee should design the ICM to produce a probability distribution of the required risk capital rather than a single point estimate.
- 4.9 The Licensee should perform procedures to assess the quantitative base methodologies of the ICM by demonstrating the appropriateness of the selected modelling techniques, by examining the appropriateness of the underlying data, and by justifying the model assumptions.

#### Data

- 4.10 The data used both as inputs to the ICM and to determine parameters for the ICM should be updated annually, at a minimum, and tested for accuracy, completeness, consistency and predictive propensity, which are described below:
  - a. Accuracy is defined as data correctness.
  - b. Completeness is defined as thoroughness of data taking into consideration the importance of missing data (e.g. is data missing for a large limit/high risk location).
  - c. Consistency is defined as data that can be collected repeatedly overtime with no variance.
  - d. Predictive propensity is defined as the ability to forecast future characteristics and outcomes within a reasonable confidence level.
- 4.11 A Licensee may utilize industry data or data obtained from other sources in order to supplement its own internal data, so long as the data used is both reliable and credible.
- 4.12 If a Licensee intends to use data obtained from reinsurers or industry data related to the reinsurance market, the Licensee should ensure that the data is reviewed and analyzed to determine whether it is appropriate for the Licensee's business and specific risk exposures.





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### Assumptions

- 4.13 Processes should be in place to review all ICM inputs and assumptions for reasonableness. The inputs and assumptions should be assessed both individually and overall. In addition to considering process risk, the assumptions and parameters should be determined taking into consideration parameter risk, especially for long-tail insurance classes, and data quality.
- 4.14 Assumptions made in the ICM shall be supportable through a quantitative analysis. Licensees should be able to explain and justify each of the assumptions, taking into account the significance of the assumption, the uncertainty involved in the assumption and why the relevant alternative assumptions are not used. Licensees should establish and maintain a written explanation of the methodology used to set those assumptions.
- 4.15 Assumptions made in the ICM are sometimes based on insufficient data support and must rely on subjective expert and management judgment or other qualitative adjustments. Examples of such assumptions might include policyholder behavior, if applicable, or the relationship between risk factors in extreme scenarios. The Authority may confirm that such assumptions are backed by the appropriate level of quantitative analysis (including benchmarking where possible) and made transparent to management in the context of a sound governance framework.
- 4.16 Future management actions can be considered as part of the assumptions made in the ICM, if these future actions are realistic and consistent with the business practice of the Licensee. The Licensee should ensure that any future management action be subject to both an objective assessment and sound internal governance.

### Testing and Documentation

- 4.17 As part of the Statistical Quality Test procedures, an analysis should be performed in order to ensure that all relevant and reasonably foreseeable risks have been incorporated into the ICM. In addition, testing should include an element of back-testing in order to compare the results of the model to the Licensee's actual historical experience.
- 4.18 Documentation of statistical quality tests procedures should be robust and the summary of the results should be written plainly. Documentation must include rationale on selected methodology and assumptions. Implicit assumptions and areas requiring judgment must be identified and documented. The Authority may confirm that the summary of the statistical quality tests have been reviewed by management in the context of a sound governance framework.
- 4.19 A review of the results of a Licensee's testing procedures should be performed by a Licensee's Board of Directors on an annual basis or more frequently.



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## 5 Calibration

### Purpose

To ensure that the regulatory capital requirement determined by the ICM satisfies the specified modelling criteria, a calibration test should be conducted. The Licensee should assess the extent to which the output of the model is consistent with the requirements listed below and hence confirm the validity of the ICM for this purpose.

### General Guidance

- 5.1 The ICM should be calibrated such that the PCR is determined using the VaR metric subject to a confidence level of 99.5% with one year of new business over a one year time horizon.
- 5.2 A fundamental premise underlying the ICM is that the assets and liabilities should be valued on a market consistent economic basis. The ICM should be based on an economic balance sheet that reconciles to the Licensee's balance sheet used for reporting purposes.
- 5.3 Licensees should fully document how the ICM is calibrated. Model documentation should include, at a minimum, a list of selected parameters, including brief commentary on justification of selections. This list should include the relevant data used to calibrate the model (e.g. loss ratios by line of business, where applicable). In addition to the selected parameters, the Licensee's historical experience data should be provided by line of business, as far back as this information is available. The documentation should also include a definition of the underlying balance sheet.
- 5.4 If parts of the ICM are designed or calibrated based on expert judgment, the documentation should detail this. The Licensee should explain and support any expert judgments made, providing analysis where appropriate. Any documentation or records of approval by management on the use of expert judgment in model building should also be included.
- 5.5 A discussion of the data used in the sample analysis to calibrate parameters of the model should be included in the model documentation. Credibility of the data used for calibration should be established, and the model documentation should discuss these points.



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## 6 Stress and Scenario Test

### Purpose

Stress and Scenario tests assess the reliability of the ICM indications and the robustness of the model in the evaluation of extreme but plausible events. This includes examination of:

- Deterministic scenarios tests;
- Deterministic sensitivity testing; and
- Deterministic and / or stochastic stress testing

### General Guidance

- 6.1 The ICM needs to be sufficiently reliable and robust to ensure that it produces a capital output which reflects all material risks and in which the key sensitivities are known. This will allow the Licensee to use the ICM within its risk management framework as a risk management and decision tool. In order to demonstrate this, the Authority requires Stress and Scenario testing to be conducted on the ICM.
- 6.2 Stress testing is a process by which a Licensee can explore reactions to small (sensitivity) or drastic (stressed) changes in conditions which affect its ICM. Stress testing should assist the Licensee with understanding the vulnerabilities of its business plan and the Licensee should use the outcomes of which to make decisions for both business and capital planning.
- 6.3 Stress testing measures loss under extreme values of the chosen variable(s) without necessarily considering the probability of that extreme event. It is an assessment of the financial impact of changing a specific variable, without regard to the likelihood of this change. All other factors would remain a constant.
- 6.4 Stress testing should focus on those remote events which bring extreme financial volatility to the Licensee and have a large impact on the tail risk. By tail risk, the Authority means those events which have a very low probability of occurring but a very large effect on the Licensee's capital demands.
- 6.5 Sensitivity testing describes a similar test but under the less extreme variation. Sensitivity testing is a simple way in which to establish the extent to which the outcomes of the ICM depend on the inputs to it. Here we would expect the Licensee to vary one input assumption at a time to quantify the effect each has independently on the ICM's outputs.
- 6.6 The stress and scenario tests are to be performed on an annual basis or more frequently as required by changes in risks and assumptions. Prior period data should be scrutinized to determine whether the data continues to be relevant.



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- 6.7 The Licensee may also want to consider running reverse stress tests as these determine the magnitude of change necessary to induce financial ruin. A reverse stress test starts with a specified outcome that challenges the viability of the firm.
  - 6.8 Stress tests should be licensee-specific (e.g. concerns with the financial condition of the Licensee or claims concentration), industry-specific (e.g. price levels or catastrophic claims) and reflective of market conditions in general (e.g. impaired capital markets).
  - 6.9 Scenario testing looks at outcomes under devised “what if” scenarios, normally measuring loss under several related stressed variables without considering the probability of occurrence of that scenario. Selection of appropriate and comprehensive scenarios often involves cross-disciplines discussions. A scenario test is a more holistic review of the circumstances affecting the Licensee rather than altering a specific variable in isolation.
  - 6.10 The Authority expects a number of departments of the Licensee to be involved with the selection of the stress and scenario tests. The departments might include the actuarial and risk teams, the underwriting team, asset managers and management.
  - 6.11 Scenario tests often include high impact but low probability events which will allow the Licensee to prepare for specific loss events. Scenario planning is a useful tool that a company may employ to help assess the resilience of the organization to internal and external shocks. Scenario testing is not supposed to consider all possible scenarios, but rather to show how the capital set using the model would stand up to stresses not expected during a normal annual course of business. The determination of the scenario tests should be appropriate to the nature, scale and complexity of the licensee’s business.
  - 6.12 Scenarios considered by the Licensee should also include combinations of interdependent events, such as adverse policyholder behavior, catastrophic claims (if applicable) and impaired capital markets.
  - 6.13 The ICM should consider all material and quantifiable risks facing a Licensee and as such, all risk categories should be included within the stress and scenario testing. The Authority will not mandate which tests should be undertaken, however they should include:
    - a. Sensitivity tests;
    - b. General Stress tests by each risk category;
    - c. Reverse Stress tests; and
    - d. Scenario Analysis.
  - 6.14 Prior to the Stress and Scenarios test being conducted, the Authority will discuss with Licensee which tests should be completed, at a minimum, based on the Licensee’s specific risks. Some examples of Stress and Scenario tests which may be included, but not limited to, are the following:
    - a. Correlations – a small change in correlations between reserving classes



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- b. Interest rates –an increase or reduction in interest rates and market volatility.
  - c. Reserve Deterioration – X% deterioration in loss reserves.
  - d. Operations Risk – large operational risk, to be chosen by the Licensee.
  - e. Historical Event – The Licensee should select an historical event to understand the outcome of the Licensee today.
  - f. Reinsurance Failure – impact on Licensee of the failure of its largest reinsurers.
  - g. Weak Economic Growth (Severe recession) – this is a macroeconomic stress scenario looking at a fall in US GDP, unemployment rising and commercial property prices falling, over a period of two years.
  - h. Two Independent Caribbean Windstorms – two windstorms impact the Caribbean, one in August (Cat 1), the other (Cat 3) a few weeks later with similar tracking to the first one, total industry loss of \$Xbn.
  - i. Pandemic – a new influenza pandemic occurs resulting in deaths globally, this includes a proportion of the US population being severely sick over the winter period.
  - j. Mortality/ Longevity risk – an increase or decrease in assumed future mortality rates
  - k. Morbidity risk – an increase in assumed future morbidity incidence rates and a reduction in claim termination rates
  - l. Persistency risk – an increase or decrease in policyholder persistency
  - m. Reverse Stress Test – The Licensee to use its ICM to develop the worst scenario(s) from which the Licensee experiences failure or ruin.
- 6.15 Additional testing may be requested by the Authority should the Licensee not demonstrate sufficient or variable enough testing. The stress and scenarios run by the Licensee should be appropriate to the nature, scale and complexity of the risks to which the Licensee is exposed.
- 6.16 The Licensee should ensure that the stress and scenario tests conducted are at a suitably extreme level to support the level of capital resulting from the PCR calculation. The severity of the scenarios should be consistent with the Licensee’s risk appetite. The Licensee should also ensure that where they employ a risk register, the tests should at a minimum be based on these risks identified and documented in its risk register.
- 6.17 The Licensee should both perform stress and scenario tests on a consistent basis year on year as well as including any additional tests which they feel are necessary given the risks the Licensee faces. The Licensee should document the differences in the results of those tests which are conducted annually should they arise.
- 6.18 Licensees should document and describe which stress and scenario tests were undertaken and why they are appropriate for the business. The results of the stress and scenario process should demonstrate that the ICM remains fit for the purposes intended under changing conditions and continues to satisfy the criteria outlined in this guidance.
- 6.19 Documentation of all stress and scenario testing should be robust and the summary of the results should be written plainly. The assumptions and fundamental elements for each stress testing exercise should be appropriately documented, including the reasoning and



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judgements underlying the scenarios chosen and the sensitivity of stress testing results to the range and severity of the scenarios. The Authority may confirm that the summary of the stress and scenario tests have been reviewed by management in the context of a sound governance framework.



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## 7 Validation

### Purpose

Validation of an ICM provides evidence regarding the appropriateness of the model prior to approval by the Authority. Validation involves subjecting the ICM to a series of tests designed to both assess if the ICM approach is appropriate for regulatory capital purposes and ensure that consistent standards exist for the approval of a licensee's ICM framework by the Authority, both at the time of initial application and on an ongoing basis.

### General Guidance

- 7.1 The ICM should be subject to periodic validation process, with the initial validation being fully comprehensive. This includes a review of its predictive performance, an ongoing assessment of the appropriateness of material assumptions and methodologies, and a review of model output for reasonableness.
- 7.2 The completion of an independent internal or external review of the development, operation and interpretation of the ICM is required prior to the Authority's review of a licensee's ICM application.
- 7.3 An independent review should be performed by parties not directly involved with the development and operation of the ICM. Independent reviewers should be skilled, sufficiently knowledgeable, and have prior ICM experience to challenge the ICM inputs, process and methodology, model outputs, and its use in decision making.
- 7.4 Areas that might be subject to validation include data, methods, assumptions and the application of expert judgment, but the Authority recognizes and reserves the right to subject other areas to validation.
- 7.5 The validation process should also include an examination of the sensitivity of ICM results to changes in key underlying assumptions, an assessment of the accuracy, completeness and predictive propensity of the data used by the ICM, and a statistically valid comparison of results to historical data, adjusted to reflect changes in exposures and conditions, to assess the robustness of the ICM.
- 7.6 The Authority recognises that a licensee's ICM may rely heavily upon the use of third-party vendor models. At a minimum, a licensee should be able to demonstrate a thorough understanding of the vendor models used, including model limitations and weaknesses (and their implications), and provide analysis around the selection of the vendor models implemented, including benchmarking and validation exercises. Any customisations to



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standard third-party vendor models to reflect individual company products, practices and risk profiles should be justified and documented.

- 7.7 The ICM should be subjected to a range of scenario and stress tests in order to assess the reliability of the ICM indications and to test the robustness of the model in the evaluation of extreme but plausible events.
- 7.8 Stress scenarios should be licensee-specific (e.g. concerns with the financial condition of the Licensee or claims concentration), industry-specific (e.g. price levels or catastrophic claims) and reflective of market conditions in general (e.g. impaired capital markets). Scenarios considered should also include combinations of interdependent events, such as adverse policyholder behavior, catastrophic claims and impaired capital markets.
- 7.9 The validation process should demonstrate that the ICM remains fit for the purposes intended under changing conditions and continues to satisfy the criteria outlined in this guidance.
- 7.10 The validation should include an element of back-testing, which would help validate the extent to which the model generates the movements and extreme positions that have been observed in the past.
- 7.11 Licensees are encouraged to engage the Authority on modeled risks and model usage to ensure sufficiency of scope and coverage of the validation process.

#### Independent Validation (Internal or External)

##### *Purpose and Expectations*

- 7.12 Validation of an ICM can give the Licensee a degree of confidence that the model is appropriate for the purpose for which it is used and an understanding of the ICM's strengths and limitations and weaknesses, which allows the Licensee to better utilise and interpret its results.
- 7.13 Independent validation reports are an important part of the review process, as the Authority believes that validation is a critical governance measure that can significantly reduce and mitigate model risk.
- 7.14 The Authority requires the production of a formal independent validation report for every validation cycle. The report should be presented, reviewed, and approved by the Licensee's Board of Directors.
- 7.15 The length of the Licensee's validation cycle is dependent on the complexity of the ICM and includes the application of the validation test; the analysis of the test results; the reporting to





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those charged with oversight; and the incorporation of any necessary changes arising from the results of the validation tests.

- 7.16 After a Licensee completes the initial validation process, it can opt to not perform a fully comprehensive validation process at every cycle, subject to no material changes to the Licensee's business risks, model inputs, methodology, and ICM governance. The Authority reserves the right to challenge the appropriateness of the scope of the validation process and the length of a validation cycle.
- 7.17 The model validation process should be an ongoing and iterative process, and validation tools and processes should be both quantitative and qualitative.

#### *Scope of Validation and Validation Report*

- 7.18 This section lays out the components that independent validation reports should ideally cover. In addition to the components listed below, validation processes such as the frequency of review and the update of key assumptions should be covered as part of the validation report unless they are covered as part of the policies, processes and procedures governing model use.
- 7.19 In general, validation reports are expected to be modular in form and should specify which parts of the model are validated. Any component of the model not within the validation scope, along with the reasons for its omission, should be specified.
- 7.20 The validation report should highlight areas which the Licensee should focus attention for future development and enhancement. The methodology and timeline for improvements should be clearly documented, and any potentially critical flaws should be prominently highlighted.

#### *Theoretical Validation*

- 7.21 The model validation should check the suitability of model structure, data, and estimation within the Licensee's business context.
- 7.22 The theoretical validation should assess appropriateness of the ICM foundation within the industry context, including methodological benchmarking to alternatives and industry best practice. The methodologies, distributions, aggregation techniques and dependencies should be consistent and follow rigorous modelling practices.
- 7.23 The Authority will pay close attention to the soundness of the dependency structures assumed in the ICM due to their potential impact on model results. The Licensee should adequately consider dependencies within and among risk categories and should justify diversification benefits. In addition, the Licensee should demonstrate that the ICM



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satisfactorily captures dependencies between risks during stress testing.

- 7.24 The theoretical validation should also assess the appropriateness of the parameter estimations made within the model. It should be demonstrated that the parameter estimations are appropriate within the market and industry context and parameter uncertainty is addressed to the extent possible.

*Analytical Validation*

- 7.25 The model validation should include an effective statistical process for validating the model which demonstrates that the results of the model are fit for the purpose for which they are used.
- 7.26 The validation should justify the implementation of the model by describing the theoretical basis, by providing evidence of assumption selections (i.e. goodness of fit), and by providing support of results (i.e. back-testing, sensitivity to changes in key underlying assumptions and stability of outputs, etc.).
- 7.27 Back-testing should be applied at various levels of the business activity such as loss ratio or equity volatility.
- 7.28 Sensitivity analysis should examine whether the model output is sensitive to changes in key assumptions. Sensitivity testing is especially important in validating parts of the internal model where expert judgment is used.
- 7.29 Validation tests should confirm the convergence of the model.
- 7.30 Validation tests should also examine the processes for model performance monitoring.
- 7.31 Where possible, analytical validation should compare ICM results and techniques with peers, available literature and research for benchmarking purposes.



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## 8 Documentation

### Purpose

All aspects of the ICM should be documented including the structure, design, inputs, assumptions made, parameters selected, stress and scenario tests completed, internal controls and governance. Documentation of the ICM should be maintained to an appropriate standard in order to support an independent review of the ICM and for the ICM to be utilized and maintained by existing and newly assigned personnel.

### General Guidance

- 8.1 Licensees are required to maintain documentation of the ICM to an appropriate standard which should include but not be limited to the following details:
- a. The scope, structure and methodology of the ICM;
  - b. Justification for and details of the underlying methodology;
  - c. Methodology used for calibration and parameterization;
  - d. The primary sources of data including maintenance, quality and relevant checks of such data;
  - e. All material assumptions and details of reliance on expert judgment and management judgment;
  - f. Processes and results of the statistical quality tests;
  - g. Validation scope, policies, procedures and findings;
  - h. Governance policies and procedures;
  - i. Policies and procedures governing model use;
  - j. Stress and scenario tests, including assumptions, fundamental elements, rationale and judgments underlying the scenarios chosen and the results of these tests;
  - k. Internal controls over the ICM including the procedures for independent review
  - l. Any other material operational aspects surrounding the ICM
- 8.2 It should be highlighted that the Authority will rely on the Licensee's existing documentation to the extent practicable in order to keep documentation prepared solely for regulatory purposes to a minimum.



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## 9 Model Governance

### Purpose

Model Governance is the establishment of a policy framework to oversee the initial application and establishment, as well as the ongoing maintenance and operation, of an ICM and to continuously monitor the implementation of those policies.

### General Guidance

- 9.1 The Board of Directors of the Licensee is ultimately responsible for the integrity of the ICM, the placement of proper management and controls around the development and use of the ICM and ensuring that the ICM plays a key role in the Licensee's risk management process. A Licensee should be able to evidence an appropriate level of discussion relating to the ICM and its outputs at the Board-level. The Board must have formally approved the ICM for use within the business and must approve the reported capital requirement.
- 9.2 The Licensee's Board and management should have a sufficient understanding of the ICM's key elements, including the implications of its outputs and its limitations for risk and capital management decisions, and ensure that an adequate understanding of the ICM exists at appropriate levels within the Licensee's organisational structure. Evidence should be supplied about the nature and extent of training given to the Board and management.
- 9.3 There must be regular reporting to the Board or a committee of the Board regarding the results of the ICM.
- 9.4 The day-to-day responsibilities relating to the ICM may be delegated to the Chief Risk Officer, or the person with responsibilities normally assumed by the Chief Risk Officer. However, the delegation of day-to-day ICM responsibilities, or use of external expertise in the development of the ICM, does not absolve the Board of its responsibility to ensure that the use of the ICM is consistent with prudent risk management and the sound and prudent conduct of the Licensee's business.
- 9.5 The Licensee's management should be responsible for ensuring the ongoing appropriateness of the design and application of the ICM, and that processes are in place to amend and refine the ICM as a Licensee's risk profile changes.
- 9.6 The Licensee should have sufficient resources, technical ability and authority to operate and maintain the ICM effectively. The Licensee's business continuity plans should include specific provisions for the backup and recovery of all critical systems needed for the continued operation and maintenance of the ICM, and succession plans should be in place to mitigate the risk of departure by personnel key to the ICM's use and development.



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- 9.7 The Licensee should test and validate the ICM on an annual basis or more frequently. The Licensee should also document any subsequent changes made to the ICM, inform the Board of the Licensee about the performance of the ICM, and recommend areas needing improvement.
- 9.8 A Licensee should decide on the appropriate balance of in-house versus external expertise relied upon in relation to the ICM, given the nature, scale and complexity of the risks they bear. Any outsourced work should meet the Licensee's own quality requirements and should be appropriate to the nature of the Licensee's business. Reliance on external expertise should be documented along with an explanation of the appropriateness of the use of the external expert.
- 9.9 The Licensee should maintain written documentation of all ICM governance policies and procedures, including internal control, organisational risk limits and tolerances, and, where relevant, internal audit and outsourcing of ICM activities.
- 9.10 Evidence should be available to show the existence of formal policies governing the review, approval, and sign-off processes applicable to the underlying theory and structure, the calibration, and the validation and testing of the various elements of the ICM. The Licensee should further be able to demonstrate that these policies have been reviewed on an annual basis or more frequently and adhered to.

#### Model Changes

- 9.11 The Licensee should have a model change policy which details the processes and procedures by which changes will be applied to the ICM. A Licensee's ICM governance process should include controls and documentation around the model change policy and an adequate process should be put in place by the Licensee to assess proposed changes to the ICM (based on changes to the Licensee's risk profile) against the approved model change policy.
- 9.12 The Licensee should document all changes made to the ICM. Major changes to the ICM or to the model change policy should be subject to approval by the Licensee's Board prior to implementation. Major changes to the ICM are also subject to review and approval by the Authority.



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## 10 Internal Controls

### Purpose

In relation to the ICM, internal controls are a framework of policies and procedures implemented by an organisation to:

- promote operational efficiency and effectiveness with respect to the ICM;
- ensure compliance with regulatory and other responsibilities;
- develop and maintain reliable data in the ICM, along with accurate and timely reporting; and
- safeguard against errors and fraud within the ICM;

### General Guidance

- 10.1 This section of the Statement of Guidance should be read in conjunction with the Rule and Statement of Guidance – Internal Controls – Insurance. A Licensee should clearly demonstrate that adequate and effective controls are in place in relation to the operation and maintenance of the ICM, including strict protocols identifying those parties who have the authority to use and make amendments to the model.
- 10.2 The scope of the internal control process should include administrative and accounting procedures, testing and control procedures, reporting requirements and compliance procedures. Once established, a Licensee’s internal control process over the ICM must be approved by the Licensee’s Board of Directors.
- 10.3 The Licensee should ensure the ongoing monitoring of the ICM and design procedures to verify that the ICM is current, uses reliable and relevant data and is operated and maintained by personnel with adequate expertise and experience. The Licensee should also include provisions for the routine review and challenge of material assumptions and parameters in the ICM, as well as cover compliance with the agreed model change policy.
- 10.4 A review of the Licensee’s monitoring procedures and the results of those procedures should be performed by a Licensee’s Board of Directors on an annual basis or more frequently. Clearly documented procedures for independent review of the ICM should be developed by the Licensee.
- 10.5 A specific control policy should also be in effect ensuring that an appropriate segregation of duties is maintained between those who are responsible for building, operating and maintaining (on an ongoing basis) the ICM and those who are responsible for making decisions based on the ICM’s output. This especially applies to the determination of assumptions and the potential for conflicts of interest in this area between conservative



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estimates and business generation.



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## 11 Risk Assessment

### Purpose

The ICM should be sufficiently comprehensive to include all material risks relating to the financial condition and performance, and business activities of the Licensee. There should be adequate documentation stating which risks are covered in the ICM and which are not, including those risks considered nonmaterial for the purposes of inclusion within the ICM.

### General Insurance Risk

- 11.1 A Licensee writing general business should model and present risks separately per the categories listed below. The Authority acknowledges that alternative risk categorizations may be more suitable dependent on the nature, scale and complexity of the Licensee and therefore encourages that alternative risk categorizations are discussed with the Authority.
- 11.2 Licensees should refer to the Insurance Law for a definition of the expression “insurance business”.
- 11.3 The Licensee should be able to provide a detailed account of the approach to modelling the following risks in the ICM, where such risks apply.
  - 11.3.1 Catastrophe Risk. The Licensee should be able to provide a detailed account of the approach to modelling catastrophe risk in the ICM. The Licensee is expected to have controls and processes in place to address the limitations and weaknesses of vendor models and to therefore not place an over-reliance on vendor models.
  - 11.3.2 Underwriting Risk
  - 11.3.3 Reserving Risk

### Long Term Insurance Risk

- 11.4 A Licensee writing long term business should model and present risks separately per the categories listed below, where such categories are applicable. The Authority acknowledges that alternative risk categorizations may be more suitable dependent on the nature, scale and complexity of the Licensee and therefore encourages that alternative risk categorizations are discussed with the Authority.
  - 11.4.1 Lapse Risk
  - 11.4.2 Other aspects of policyholder behavior that have the potential to result in insurance losses
  - 11.4.3 Mortality and Longevity Risk
  - 11.4.4 Disability and Morbidity Risk





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11.4.5 Expense Risk

11.4.6 Catastrophe Risk

#### Market Risk

11.5 Market risk is defined as the risk to an insurer's financial condition arising from movements in the level of volatility of market prices of assets, liabilities, and financial instruments, whether on all investments as a whole (general market risk) or on an individual investment (specific market risk). The following are some of the market risks an insurer may be exposed to:

- a. interest rate risk;
- b. equity risk;
- c. property risk;
- d. currency risk;
- e. credit spread risk; and
- f. concentration risk.

11.6 The Licensee should be able to provide a record of each material market risk to which its assets, liabilities, financial instruments or an individual investment may be exposed. The Licensee should be able to provide a detailed account of the approach to modelling these risks in the ICM (where applicable).

#### Credit Risk

11.7 The Licensee should be able to provide a detailed account of the approach to modelling credit risk in its ICM.

#### Operational Risk

11.8 The Authority recognizes that operational risk management is still a relatively new discipline and that Licensees face considerable challenges in modelling operational risk. Licensees should include operational risk within their ICM or alternatively document the approach taken to manage operational risk.

11.9 Various approaches can be considered in modelling operational risk and a licensee should document how the approach taken accurately reflects its risk profile.

11.10 The Licensee should describe the controls in place to mitigate against operational losses.

#### Liquidity Risk

11.11 The Authority understands that Liquidity Risk may not call for an explicit capital provision like other risks, and may be assessed outside the ICM. However, to the extent liquidity risk is considered in the ICM, the Authority will aim to confirm that it is done so appropriately



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during the ICM review process.

- 11.12 When considering liquidity risk, it is important to match the sources of liquidity within the asset portfolio to the liquidity needs of the insurer's liabilities. Any events that require an insurer to commit assets in support of related-party guarantees, letters of credit, or other agreements requiring some form of security, which may lead to a lack of liquidity, should be considered.
- 11.13 The Licensee should be able to provide a description detailing the treatment of liquidity risk in the ICM.

Sources of and constraints on capital

- 11.14 The Licensee should continually assess the link between its risk exposure and the capital needed to manage its business. As part of that assessment, the Licensee should consider the current and potential sources of obtaining additional capital and the risks associated with each, including whether these capital structures would facilitate or hinder future re-capitalization.
- 11.15 The Licensee should consider the impact on its capital assessment in the context of the Licensee's group. This includes assessing existing or potential restrictions on capital due to requirements in other jurisdictions, and the Licensee's available capital should be clearly identified to avoid the risk of double counting.



## 12 Glossary

| <b>Term</b>               | <b>Definition</b>  |
|---------------------------|--|
| Accuracy                  | The correctness of the data  |
| Back-testing              | Back-testing is a method to assess predictive performance of a model. Back-testing assesses the ability of the model to replicate the observed outcomes over a period of time.   |
| Business Continuity Risk  | The risks that threaten or disrupt an insurer's continuous operations, such as risks arising from natural and man-made hazards.  |
| Calibration Test          | A test to demonstrate that the regulatory capital requirement determined by the Licensee's ICM satisfies the specified modelling criteria.   |
| Catastrophe Risk          | The risk of a single event or series of events that can either be man-made or naturally occurring and that result in significant insurance losses  |
| Completeness              | The thoroughness of data taking into consideration the importance of missing data (e.g. is data missing for a large limit/high risk location).   |
| Compliance Statements     | The Authority's minimum standards pertaining to the ICM that the Licensee must observe and fully comply with, in order for the Authority to grant approval.  |
| Concentration Risk        | The exposure to increased losses associated with inadequately diversified portfolios of assets and/or obligations, or from large exposure to default risk by a single issuer of securities or a group of affiliated issuers  |
| Confidence Level          | A confidence level in a Value-at-Risk model refers to the percentage of all possible outcomes that can expect to include the true population outcome.  |
| Consistency               | The data that can be collected repeatedly over time with no variance.  |
| Correlation               | Correlation is a measure of dependence between two variables or quantities.  |
| Credit Risk               | The risk of financial loss resulting from default or movements in the credit rating assignment of issuers of securities (in the insurer's investment portfolio), debtors (e.g. mortgagors) or counterparties (e.g. on reinsurance contracts, derivative contracts or deposits), and intermediaries, to whom the Licensee has an exposure |
| Credit Spread Risk        | The risk of loss resulting from changes in the level or in the volatility of credit spreads over the risk-free interest rate term structure.   |
| Currency Risk             | The risk of capital losses as a consequence of fluctuations in exchange rates.   |
| Deterministic Model       | A model where the inputs to the model take the form of fixed variables and contain no random components.   |
| Disability/Morbidity Risk | The risk of loss due to changes in the level, trend or volatility of disability or morbidity rates.  |
| Economic Balance Sheet    | A balance sheet constructed on an economic basis where the fair value of financial assets and liabilities is determined using market-consistent values.  |
| Equity Risk               | The risk of a change in value caused by deviations of the actual market values of equities and/or income from equities from their expected values.   |
| Expense Risk              | The risk of loss due to changes in the expenses incurred in conducting   |



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|                          | business operations in scope for the determination of the PCR.  |
| Expert Judgment          | Information or opinions obtained from individuals with specialized, relevant expertise that is incorporated into the ICM.   |
| ICM                      | “internal capital model” means a risk management system developed by an insurer to analyse its overall risk position, to quantify risks and to determine the economic capital required to meet those risks.   |
| Insurance Risk           | Insurance risk is directly or indirectly associated with the technical or actuarial bases of calculation for premiums and technical provisions as well as risks associated with operating expenses.   |
| Interest Rate Risk       | The risk of loss resulting from a change in value caused by a deviation of the actual interest rates from the expected interest rates.  |
| Internal Controls        | A framework of policies and procedures implemented by a licensee to promote operational efficiency and effectiveness with respect to the ICM, ensure compliance with regulatory and other responsibilities, develop and maintain reliable data in the ICM, along with accurate and timely reporting, and safeguard against errors and fraud within the ICM. |
| Lapse Risk               | The risk of loss due to changes in the level, trend, or volatility of the rates of policy lapses, terminations, renewals, conversions and surrenders.   |
| Liquidity Risk           | The risk that an insurer is unable to realize its investments and other assets in a timely method in order to settle its financial obligations as they fall due.  |
| Market Risk              | Market risk is defined as the risk to an insurer’s financial condition arising from movements in the level of volatility of market prices of assets, liabilities, and financial instruments, whether on all investments as a whole (general market risk) or on an individual investment (specific market risk).   |
| Model Governance         | The establishment of a policy framework to oversee the initial application and establishment, as well as the ongoing maintenance and operation, of an ICM and to continuously monitor the implementation of those policies.   |
| Mortality/Longevity Risk | The risk of loss due to changes in the level, trend, or volatility of mortality rates. Mortality risk is typically used to describe the case where higher mortality leads to losses; longevity risk is typically used to describe the case where lower mortality leads to losses  |
| Operational Risk         | The risk of loss caused by actual losses deviating from expected losses that arise from failed or inadequate internal processes, people, systems, or from external events.  |
| Parameter Risk           | A change of value caused by the uncertainty in the estimation of the parameter values applied in a model.   |
| PCR                      | “prescribed capital requirement” means the total risk based capital that an insurer must maintain in order to operate in a safe and sound manner as set out in Schedule 1 of The Insurance (Capital and Solvency) (Classes B, C and D Insurers) Regulations, 2012.  |
| Persistency Risk         | The risk of a change in value due to deviations in policyholder behaviour from its expected value. This may include behaviors such as lapses, premium continuation, partial withdrawals and annuitization rates.  |
| Predictive Performance   | See Back-testing.   |



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| Predictive Propensity    | The ability to forecast future characteristics and instances within a reasonable confidence level.   |
| Process Risk             | The risk of data entry and data processing errors arising from application design misspecifications.   |
| Property Risk            | The risk of loss resulting from changes in the level or in the volatility of market prices of real estate.   |
| Reserving Risk           | The possibility that technical provisions for claim liabilities arising from current and prior exposure periods will not be sufficient to satisfy their ultimate cost.   |
| Reverse Stress Test      | Reverse stress tests are stress tests that require a firm to assess scenarios that would render its business model unavailable (e.g. through insolvency)   |
| Scenario Analysis        | A scenario analysis consists of varying a number of model parameters together to determine the potential loss to the business of a particular event.   |
| Sensitivity Testing      | Sensitivity testing involves assessing the potential impact on the business through small variations of individual model parameters  |
| Statistical Quality Test | A test to assess the base quantitative methodology of the ICM, which demonstrates the appropriateness of the model inputs and parameters and justifies the assumptions underlying the ICM.   |
| Stochastic Model         | A model where one or more inputs are assumed to be a random variable and vary over time.   |
| Stress Testing           | A technique used to evaluate the potential impact on a Licensee's capital due to specified changes in risk factors. Stress testing includes scenario testing and sensitivity testing.  |
| Tail Risk                | Events which have a very low probability of occurring but a very large effect on a Licensee's capital demands.   |
| Underlying Balance Sheet | The balance sheet used by the licensee for financial reporting purposes (e.g. under IFRS, US GAAP, etc.)   |
| Underwriting Risk        | The risk that the Licensee's underwriting activities, including the selection and pricing of risks, and/or a deviation of the actual claims payments from the expected amount of claims, will result in financial loss in respect of current in force business and potential future business.  |
| Use Test                 | A test to assess whether the ICM, its methodologies and results are fully embedded within the Licensee's risk strategy and operational processes.  |
| Validation               | Validation involves subjecting the ICM to a series of tests designed to both assess if the ICM approach is appropriate for regulatory capital purposes and to ensure that consistent standards exist for the approval of a licensee's ICM framework by the Authority, both at the time of initial application and on an ongoing basis. |
| VaR                      | "value-at-risk" means an estimate of the worst expected loss over a certain period of time at a given confidence level.  |