LLOYD'S

Lloyd's Minimum Standards MS14 - Validation

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Contents

MS14 - Validation

Minimum Standards and Requirements

These are statements of business conduct required by Lloyd's. The Minimum Standards are established under relevant Lloyd's Byelaws relating to business conduct. All managing agents are required to meet the Minimum Standards. The Requirements represent the minimum level of performance required of any organisation within the Lloyd's market to meet the Minimum Standards.

Within this document the standards and supporting requirements (the "must dos" to meet the standard) are set out in the blue box at the beginning of each section. The remainder of each section consists of guidance which explains the standards and requirements in more detail and gives examples of approaches that managing agents may adopt to meet them.

Guidance

This guidance provides a more detailed explanation of the general level of performance expected. They are a starting point against which each managing agent can compare its current practices to assist in understanding relative levels of performance. This guidance is intended to provide reassurance to managing agents as to approaches which would certainly meet the Minimum Standards and comply with the Requirements. However, it is appreciated that there are other options which could deliver performance at or above the minimum level and it is fully acceptable for managing agents to adopt alternative procedures as long as they can demonstrate the Requirements to meet the Minimum Standards.

Lloyd's provides guidance in addition to the Minimum Standards on relevant areas of www.lloyds.com

Definitions

GAAP – Generally Accepted Accounting Principles

LCR – The Lloyd's Capital Return

SCR – Solvency Capital Requirements is the amount of funds that insurance and reinsurance undertakings are required to hold in the European Union.

The Board - Where reference is made to the Board in the standards, managing agents should read this as Board or appropriately authorised committee. In line with this, each agent should consider the matters reserved for the Board under the Governance Standard in order to evidence appropriate full Board discussion and challenge on the material items.

Section 1: Validation Policy

VAL 1.1 Maintenance of a validation policy

Managing agents shall establish, implement and maintain a validation policy which sets out the way in which they will validate the internal model, and explains why their approach is appropriate.

Managing agents shall ensure that the validation policy specifies at least:

- the purpose and the scope of the process;
- the processes and methods used to validate the internal model;
- for each part of the internal model, the frequency of regular validations and the circumstances which trigger additional validation;
- the persons who are responsible for each validation task;
- the procedure to be followed in the event that the validation process identifies problems with the reliability of the internal model and the decision-making process to address those concerns;
- an assessment by the managing agent of the quality of the validation process; and
- an assessment of the independence of the validation process.

Managing agents shall include any other material matters relevant to their approach to validating the internal model as satisfactory coverage of these elements alone does not guarantee compliance with the tests and standards.

The validation policy must set out the validation tools that are used. The broad description of a validation tool is “any approach designed to gain comfort that the internal model is appropriate and reliable”. It is up to each managing agent to decide which tools will be used. Various validation processes and tools that a managing agent may choose to employ are set out in section 4 below. Many of the validation processes and tools described are mandatory under level 2 guidance, including stress and scenario testing, sensitivity testing, and back testing. It is strongly recommended that these tests should be applied to every major risk module of the standard SCR formula in order to validate the model including comparison against the standard SCR calculation. The use of the model for ‘risk ranking’ should also inform agents as to which risk areas should be tested as a priority.

A key element of the validation process is the setting of pass/fail criteria for validation tests, since failures could indicate problems with the reliability of the internal model. The validation policy must set out how such cases are to be managed, including escalation as far as the Board, if appropriate. Validation failures may also lead to the recognition of model limitations and management add-ons to capital, the escalation process for which should also be covered by the validation policy.

The validation policy must demonstrate that it sets out an independent validation process and must explain how independence is achieved.

Section 2: Validation Governance

VAL 2.1 Independence and objective challenge

Managing agents shall ensure that the validation process shall be independent from the development and operation of the internal model and subject to objective challenge.

Managing agents shall ensure that:

- the validation process and outcomes shall be subject to a level of objective review and challenge sufficient to justify the conclusions reached on the quality of the validation process;
- the validation process shall incorporate governance to ensure that validation results are escalated where necessary;
- the escalation path for validation results shall also be independent of the development and operation of the internal model; and
- the risk management function has responsibility for testing and validating the internal model.

The agent's definition of "independence" should be detailed and explained. One possible interpretation is that it is reviewed by individuals who were not involved in, and free from influence of, the model's design, development, parameterisation or operation, which could include external and internal staff. Independence does not require that only those with no connection to the model should be involved in the validation, only that all aspects of validation should incorporate an independent view. This certainly allows for the modelling team to conduct validation which can be used in the independent validation process, provided an adequate independent review element is incorporated.

Article 44(5) of the framework directive sets out that the risk management function shall be tasked with testing and validating the internal model. Owing to the wide-ranging scope of the internal model and of the validation of the internal model, it may be that the risk management function is not always in the best position to perform the tasks set out in the validation policy. It may be more practical in some cases for other parties to complete some of the tasks required in the validation process. The risk management function must remain responsible for co-ordinating the completion of the various tasks.

The independent review will require various skills and expertise and agents must be able to demonstrate that the process involves sufficient skills in all areas of the model to be validated. The managing agent should also explain the role of the internal audit function in the validation of the model where they are involved and show that it is not incompatible with the normal "third line of defence" role. Third party reviewers should have terms of reference making clear the nature of their role.

Agents must also consider how independence is maintained over time. As an example, if model changes are implemented in response to an independent review, the review of the change by the same reviewer in future validation cycles may result in a decrease in independence over time. A proportionate approach to maintaining independence over time needs to be taken to ensure that it is manageable.

Assessment of independence should explicitly cover as a minimum:

- in relation to the internal validation process, the responsibilities and reporting structure of the persons involved in the process; and
- in relation to any external validation process, the remuneration structure of the persons, including where applicable their employees or other persons acting on their behalf, who are involved in the process and any other mandates of these persons relating to the agent or syndicate.

The existence of objective challenge is crucial in maintaining an effective validation process. It is the responsibility of the risk management function to ensure that the tasks set out in the validation policy create and maintain independence, as noted above.

Managing agents must be able to demonstrate the existence and use of a clear escalation path setting out how the results are escalated within the governance structure of the internal model. The escalation procedure followed for failed tests must be undertaken in compliance with the validation policy.

Section 3: Validation Process

VAL 3.1 Frequency and scope

Managing agents shall ensure that the internal model validation shall be carried out on a regular cycle and cover all components of the internal model.

Managing agents shall ensure:

- the validation process shall apply to all parts of the internal model and shall cover all requirements set out in Articles 101, 112, 120 to 123, 125 and 126 of Directive 2009/138/EC;
- they test the results and key assumptions of the internal model at least annually; and
- they test the results and key assumptions following events as identified in the model change policy.

The scope of validation is wide and covers the full scope of the internal model and not just the calculation kernel. For example any IT systems defined as being included within the internal model should by default be considered for inclusion within the scope of the validation. Managing agents will need to consider carefully where to draw the line between policies within the scope of the internal model and policies and processes that are linked to the internal model but outside the scope of the approval process. All areas within the scope of the model must be covered by validation.

The level 2 guidance requires the validation process to at least cover the following areas (alongside each, examples of what validation might look like are given):

Area of Validation	**Example**
Data	Accuracy, appropriateness and completeness checks, data reconciliations
Methods	Selected statistical distributions are supported by the data (or at least are not contradicted by past history)
Assumptions	Validated against actual experience or market data
Expert Judgement	Actuarial judgement is challenged by underwriters' views and vice versa
Documentation	Evidence that it has been read and approved by relevant staff
Systems/IT	Appropriate systems controls, file back-ups and security in place
Governance	Evidence that validation output is reviewed by appropriate committees
Use	Evidence that the model is genuinely used and appropriate for the use. Show minutes, supporting analysis and any workflow history. Show how use influences model design and subsequent changes

Full cycle validation is considered to contain:

- the application of the validation test or tool;
- the analysis of test results;
- the escalation of test results to appropriate individuals in the business; and
- the implementation of any changes necessitated by the validation test outcome.

The full cycle of validation of the internal model must be at least an annual process, which does not necessarily mean every part of the validation occurs strictly every twelve months, as some parts may be more frequent, or triggered by

events, such as changes in the business plan. Any model methodology review should consider the current methodology alongside the latest risk profile. The timing of the validation cycle also needs to be capable of supporting calculation of capital requirements and model change.

VAL 3.2 Compliance and confirmation

Managing agents shall conduct internal model validation in compliance with the validation policy, in order to give the confirmations required by Lloyd's.

Managing agents shall ensure that:

- the validation process shall be conducted and validation tools selected and applied in compliance with the validation policy; and
- the validation report shall be written and authorised in compliance with the validation policy, and shall support managing agents in making the following confirmations:
    - the validation has been conducted in compliance with the validation policy;
    - the validation process has been conducted with sufficient independence;
    - the internal model is reliable and its results appropriate; and
    - all material components and risks have been tested.

Managing agents must have a validation policy containing all the elements required by level 2 guidance (see standard VAL1.1) and must manage the process in compliance with the policy, in order to achieve the level of comfort set out in the policy and give the confirmations required by Lloyd's.

Lloyd's may amend and re-issue the required confirmations from time to time. The aim of the confirmation statements is to provide an explicit confirmation that the objectives of the validation process have been met. Managing agents' Boards will be required to provide the confirmations based on the validation report, but the confirmations do not form part of the report itself.

VAL 3.3 Validation results

The validation process shall support conclusions about the appropriateness and reliability of the internal model.

Managing agents shall ensure that the:

- validation tests shall result in conclusions about the appropriateness of the area being validated;
- tests giving results outside pre-defined requirements shall be addressed in accordance with the validation policy and shall be subject to escalation and further validation, if appropriate; and
- the validation process shall cover all material limitations in the internal model and their impact on the appropriateness and reliability of the model.

Validation is considered to be a critical part of demonstrating that the internal model is suitable for the expected uses, and in particular, setting capital for regulatory purposes. The validation process must lead to results which enable the Board to determine the reliability and appropriateness of the model for each use and provide appropriate escalation of any findings.

Section 4: Validation Tools

VAL 4.1 Basis of validation

Actuarial and statistical methods shall be tested on current information and practice and a detailed understanding of the model.

The validation of the actuarial and statistical methods referred to in Article 124 of Directive 2009/138/EC shall be based on:

- current information, including actuarial progress and the generally accepted market practice; and
- a detailed understanding of the theory and assumptions underlying the methods.

Managing agents are required to use current actuarial methods and techniques and relevant, up-to-date information in validating internal models. This is essential in ensuring that managing agents can continuously improve their models. This does not imply that internal models should always be based on the most commonly used methods; managing agents remain under a responsibility to seek out the best approach for reflecting the business and risk profile of their syndicates.

Managing agents should demonstrate their detailed understanding of the theory and assumptions underlying their models in the design and application of a specific, detailed and appropriate validation programme including the use of relevant tools. This understanding should be supported by the design and operation of the validation process, and validation failures should be used to improve understanding, as well as enhancing the model itself.

This area forms an integral part of the validation testing undertaken by an agent to ensure that the actuarial approach is appropriate. The validation report is the tool by which the managing agent's appropriate committee and Board obtain comfort that this has been undertaken together with the escalation process for any tests that are failed.

VAL 4.2 Experience

Managing agents shall ensure that appropriate testing of the internal model against experience is undertaken.

Managing agents shall:

- test the results and the key assumptions of the internal model against experience and other appropriate data to the extent that data are reasonably available;
- apply the tests to aggregated results and appropriate single elements of the results. At a minimum Lloyd's expects this to be at a risk category level, and at a class of business level, where possible;
- identify the reason for any significant divergence between assumptions and results; and
- ensure actuarial and statistical methods are tested against current data and market practice based on a detailed understanding of the model.

The testing of results of the internal model against experience is used to assess the variances between forecasts made by the model and actual outcomes. Where actual outcomes may not be directly available, the model forecasts may be compared to those made on the basis of a comparable data set. Such datasets may include, for example, market level data, data from other parts of the group or data based on other business deemed to have similar characteristics.

Managing agents should justify why the chosen comparable data set is appropriate. The reliability of the test depends on the selection of data used and specific attention to the data selection will increase the comfort managing agents obtain from the test.

This type of test against experience, or “back-testing”, can be used to find various kinds of discrepancies. The objective of the analysis is, for example, to determine whether differences come from omission of material risk factors from the model, whether they arise from errors from other aspects of the model specification such as the dependency structure including the assumptions of linearity, or whether the discrepancies are purely random and thus consistent with acceptable performance of the model.

One way to use back-testing is to test statistically the hypothesis that the observed frequency of exceptions equals the expected frequency, subject to the availability of adequate data. Managing agents should use back-testing widely, as it offers useful information about the model which is relatively easily understood by directors and other model users.

VAL 4.3 Sensitivity Testing

The sensitivity of the internal model results to changes in key assumptions shall be tested.

Managing agents shall:

- assess the effect on the results of the internal model of changes in the key assumptions underlying the model; and
- where the results of the internal model are highly sensitive to an underlying assumption, be able to explain the underlying reasons and how this is taken into account in their decision-making process.

Sensitivity testing is a required test which aims to challenge the internal model by testing the sensitivity of the results to changes in key underlying assumptions including future management actions. The analysis may be performed by introducing small changes to the assumptions such as to the parameters, but also to some more structural aspects of the model like mathematical methods or statistical distributions. For instance, to test the sensitivity of the results to the choice of a particular statistical distribution selected, agents may use a range of alternative distributions and analyse the impact that the change of the distribution has on the results.

There are two types of sensitivity tests that should be carried out:

- ST-1 tests deterministically vary a set of assumptions
- ST-2 tests use a plausible alternative of a given assumption.

There are multiple objectives that sensitivity tests can help achieve. At a basic level, they can be used to check the model is working as expected i.e. if a certain parameter is increased then can check that the model output has moved in the direction expected. Sensitivity testing can also be used in validating parts of the internal model which place reliance on expert judgement, to assist in determining their materiality. In particular, testing the sensitivity of the internal model may also be useful to identify cases where a small difference in the input leads to significant changes in the output.

Whilst agents are required to use sensitivity testing where appropriate, they should be aware that sensitivity testing alone does not provide sufficient challenge and comfort to the chosen input parameter, so should seek to apply additional validation tools.

VAL 4.4 Required tools

Managing agents shall ensure that the validation process shall be conducted using appropriate validation tools to provide comfort that the internal model is appropriate and reliable for internal use and for the SCR calculation.

Managing agents shall consider using qualitative and quantitative tools to achieve the required comfort, including but not limited to those required below:

- the model validation process shall include an analysis of the stability of the outputs of the internal model for different calculations of the internal model using the same input data;
- agents shall develop and carry out their own stress tests and scenario analysis, taking into account their particular business and risk profile;
- the model validation process shall include a reverse stress test, identifying the most probable stresses that would threaten the viability of the syndicate;
- the validation process shall include an analysis of the results of the profit and loss attribution referred to in Article 123 of Directive 2009/138/EC;
- the validation process shall include any approximations referred to in Article 122(3) of Directive 2009/138/EC; and
- the stress testing and scenario analysis and their results shall be monitored and assessed by agents on an ongoing basis and updated at least annually.

Managing agents are expected to be able to demonstrate use of a wide range of appropriate and effective validation tools, based on defined and documented selection criteria. They should be able to explain how the selected tools meet the validation objectives and why they are more appropriate than alternatives.

The following tools can be used in the validation process:

	Validation Process	**Description**
1	**Stress and scenario test**	Construct hypothetical extreme scenario (or combination of scenarios) and assess the likelihood and loss (earnings) impact. Compare this impact and likelihood to those in the model
2	**Reverse stress test**	Determine the level of loss which would lead to unviability and work backwards to determine the scenario(s) which might lead to that level of loss. As a minimum, the level of loss should be defined at a risk category level.
3	**Back test**	Compare actual results with modelled distribution – do they fall within the range expected by the model?
4	**Sensitivity test**	Vary individual model parameters to assess the impact on capital. Validation should include both ST-1 and ST-2 Sensitivity Testing
5	**Simulation/convergence test**	Test to see how stable the modelled capital figure is to varying the seed or increasing the number of simulations
6	**Profit & Loss attribution**	Check to ensure actual profits/losses booked can be explained by risks being modelled. Are all sources of profit/loss captured by the model?
7	**Standard SCR formula comparison**	Compare and reconcile results of each main standard formula risk module with the corresponding internal model

		output. If material, agents may also consider reconciliation with sub-modules.
8	**'As-if' losses**	For catastrophe losses in particular: replicate the footprint of actual previous catastrophe events and determine as if losses from existing exposures. Does the catastrophe model generate the anticipated level of loss? Compare to actual experience and reconcile differences for change in risk profile, reinsurance arrangements etc Does the model generate similar aggregation of actual losses e.g. World Trade Centre losses across various classes?

Managing agents should have a documented process in place to choose the appropriate suite of validation tools in order to ensure a robust validation process; this may be covered adequately in the validation policy in some cases. The following characteristics or issues should be considered when selecting the validation tools:

- Level of sophistication – validation tools range from simplified techniques to sophisticated methods;
- Nature – validation tools may be qualitative, quantitative or a combination of both;
- Knowledge required - The extent of knowledge required by the persons doing the validation;
- Independence - The level of independence required by the persons doing the validation;
- Information Available - The extent of the types of information available for external versus internal validation; and
- Cycle of validation – Validation will be performed at different stages of the internal model from development, to implementation, to operation.

In addition to managing agents developing their own suite of stress tests, Lloyd's may specify market-wide stress and scenario tests, including the existing Realistic Disaster Scenarios.

As a required tool, stress and scenario tests will be reviewed at least annually as part of the validation process, but Lloyd's takes the view that managing agents should reconsider their scenarios whenever the circumstances or information on which they depend changes materially. Managing agents should document the circumstances under which scenarios will be reviewed.

VAL 4.5 Profit and loss attribution

Managing agents shall demonstrate an understanding of the causes and sources of profits and losses, show how they are explained by the categorisation of risk in the internal model and make appropriate use of the profit and loss attribution within the business.

Managing agents shall, when conducting the Profit & Loss attribution:

- define the profit and loss in terms of the economic balance sheet;
- explain sources of profit and loss in respect of the major business units of the syndicate;
- explain profit and loss based on the categorisation of risks chosen in the internal model and show how this explains the results by business unit;
- ensure that it is performed at least annually;
- ensure it is used in the management of the business and demonstration of use test; and
- ensure it is used to in the validation process, as a minimum to validate that the internal model appropriately reflects the risk profile of the syndicate.

Definition and explanation of profits and losses

The definition of profit and loss in the attribution needs to be consistent with the SCR, which means that it must be based on the economic balance sheet movement. Managing agents can use GAAP profit and loss for P&L attribution, if they consider that this is better understood within the business, but it is essential in that case that the GAAP basis can be demonstrated to be consistent with the economic basis. Managing agents must be able to show that users understand whether they are using a GAAP or economic basis, and, where appropriate, the reasons for doing so.

Lloyd's will expect to see this undertaken in an objective and transparent manner with consistency over time in the attribution of profits and losses, and in the relationship of profits to the internal model. Optimistic profit assumptions should not occur routinely if profit and loss testing is applied appropriately.

Lloyd's expects the profit and loss attribution exercise to be carried out at both a risk category and class of business level, consistent with the level of assumption setting within the modelling. It is not sufficient to only consider the profit or loss at a total or major risk category level.

Section 5: Validation Report

VAL 5.1 Documentation of validation process

Managing agents shall ensure that the validation results are documented in a validation report.

The Validation report (and supporting technical documentation) shall:

- outline the validation performed for each syndicate under management;
- be submitted to Lloyd's at least annually in line with the LCR submission timetable;
- be prepared in line with Lloyd's guidance on internal model validation;
- include the validation results, and conclusions and consequences from the analysis of the validation results;

In addition:

- If parts of the validation have been delegated to internal or external parties, the data, tools and results shall be documented in the validation report;
- the validation report shall describe the validation tools used and the reasons for selecting them;
- the validation report shall include a description of known limitations in the internal model and the validation of the internal model, including the impact and materiality of the limitations. Accumulations of limitations, both of the internal model and the validation should also be considered and noted. Action taken to mitigate the effect of the limitations shall be described; and
- the validation report shall describe the actions taken to ensure the adequacy of independence and objective challenge.

The primary purpose of the validation report is to demonstrate that agents have completed sufficient work to gain confidence that the model is capturing all the risks to which syndicates are exposed, that these risks are modelled appropriately, and that key stakeholders have a thorough understanding of the materiality and sensitivities around each element of risk. Validation is a fundamental part of acceptance of the internal model into the business and the validation report should reflect this.

The validation report should be primarily an internal document that the agent uses to give its Board comfort that the internal model and corresponding SCR calculation are appropriate for the business and meet the relevant regulatory requirements. For this reason, Lloyd's does not intend to mandate the exact format or content of the validation report. Agents should first and foremost produce a validation report that is appropriate for their business and internal model structure.

Section 6: Risk Indicators

VAL 6.1 Risk indicators

Managing agents shall ensure that all material, quantifiable risks are covered by the model and adequately validated.

The internal model shall be able to rank all material quantifiable risks within the internal model scope. The internal model risk ranking should be consistent with the risk management view.

The assessment of whether all such risks are covered shall take into account an appropriate set of qualitative and quantitative indicators specified by the managing agent.

The qualitative indicators shall include at least the following:

- the identification in the own risk and solvency assessment of risks other than those that are covered by the internal model;
- the existence of a dedicated risk management process for risks other than those that are covered by the internal model; and
- the existence of dedicated risk mitigation techniques for risks other than those that are covered by the internal model.

The quantitative indicators shall include at least the following:

- the capital allocation;
- the amount of profits and losses which cannot be explained by the risks covered by the internal model; and
- the results of stress testing and scenario analysis and any tool in the model validation process.

Managing agents must be able to show that all material, quantifiable risks are covered within the scope of the internal model, and hence within the capital calculation. The risk ranking must be of sufficient quality that the managing agent can rely on it to make decisions about model use, validation and other business functions, such as risk management. Managing agents must document the risk ranking, the risk indicators and the governance and controls applied to them. There must be an escalation process, and a feedback loop to support continuous improvement both of the ranking and the internal model.