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Appendix **32**

Purpose

Provides California ISO (CAISO) testing guidelines for Generating Units, Curtailable Demand Resources, System Resources and non-generator resources for CAISO reliability testing, SC requested PMax testing, SC requested pre-commercial operations testing and SC requested emissions testing.

1. Responsibilities

Scheduling Coordinator (SC)	• Submit requests for Ancillary Services (AS) certification testing to ASNotifications@caiso.com. • Coordinate between the CAISO and resource for test scheduling and testing details. • Submit RDT (Resource Data Template) for Master File updates. • Submit Outage request for resource certification testing. • Submit E-Tag to comply with Interchange schedule requirements for dynamic and pseudo-tie resources.
CAISO Resource Test Administrator	• Ensure a nondiscriminatory testing process. • Coordinate the process on behalf of the Scheduling Coordinator. • Coordinate resource market tests and manage test data. • Ensure required telemetry is in place prior to conducting resource market test. • Coordinate with CAISO System Operations, SC, Resource, and resource owner to perform resource market tests. • Coordinate exchange of data between the Scheduling Coordinator, System Operations, and Outage Coordination.
CAISO Operations Planning Engineer	• Perform Engineering review of requests for certification of Curtailable Demand.
CAISO Generation Dispatcher	• Approve tests in Real-Time. • Manage Outage Request status in outage management system. • Maintain adequate regulating margin. • Approve/Deny Outage Requests. • If the test is SC-initiated, enter Exceptional Dispatch (ED) in the ED tool when test energy is 50 MW or greater and the resource does not have market schedules.

	• If the test is CAISO-initiated, ED should be logged in the ED tool regardless of whether the test energy is above or below 50 MW to allow for BCR settlements. • The CAISO Generation Dispatcher has the Authority to issue Operating Instructions to any generator connected to the grid with a PGA (Participating Generator Agreement).

2. Scope/Applicability

2.1 Background

The CAISO requires each resource that provides energy, capacity, and other capabilities to be tested for each service, which the resource bids or self-provides into the CAISO market. NERC (North American Electric Reliability Corporation) standards and WECC (Western Electricity Coordinating Council) regional standards require resources with deployable reserves to meet certain criteria and require the CAISO to test these resources. In addition, Scheduling Coordinators may perform SC-initiated testing due to environmental, permit, return to service equipment, performance or other testing that relates to the resource's administrative actions required by applicable regulatory requirements. (See CAISO Operating Procedure 5370 Resource Performance Verification for resource performance testing)

2.2 Scope/ Applicability

The CAISO Tariff gives the CAISO the authority to test resources that desire to bid or self-provide generation, Ancillary Services (AS), or Curtailable Demand.

All CAISO's test processes must achieve the following:

- Ensure consistent test practices and evaluation techniques.

Determine the Resource capabilities such that the full range of AS or other capabilities can be identified:

- Accurately identify service specific limitations.
- Validate data on Resource Test Request Form as provided by requestor.
- Validate performance of resources during testing.

Scheduling Coordinators may initiate testing required by regulatory mandates or to meet other administrative requirements such as PMax testing.

3. Procedure Detail

3.1 General Testing Information and Requirements

This subsection provides testing information and requirements that apply to all resource tests.

3.1.1 Resource Testing Technical Information

Technical terminology and definitions associated with resource tests are discussed below:

Part	Details
Test Duration	The time typically allocated to perform resource testing or as required for Scheduling Coordinators initiated testing. The complete test time depends upon the type of service being tested, the type of resource being tested, and the system conditions at the time of the test.
Use of Test Results	The test value(s) observed during a test are used to verify the resource data characteristics requested prior to entry in Master File. SCs submitting the Resource Test Request Form should be aware that it is their responsibility to submit updates to the Master File based on the Test Results.
Payment for Test Energy	CAISO-initiated reliability PMax test that requires CAISO commitment is considered a CAISO commitment and eligible for bid cost recovery according to CAISO tariff provision. If a resource fails such a CAISO initiated reliability test, the resource owner must change its resource characteristics accordingly or submit an outage to reflect test results. Any retests will be considered SC requested and not eligible for bid cost recovery. All SC requested testing and all AS testing that requires a resource commitment is not eligible for bid cost recovery. All ED Test Energy produced during unit testing should be paid according to CAISO tariff provisions. Test Energy not associated with a Test ED is settled based on whether it is instructed or not instructed.

Part	Details
PMax and PMin Test Requirements	All resources requesting testing for the first time must test a PMax and PMin. PMax tests are also required if requesting to increase a PMax or decreasing a PMin in the Master File. All resources testing or re-testing for PMax and PMin are required to review their Heat Rate, Ramp Rate, and Forbidden Range data listed on their RDT for changes based on the newly approved PMax and PMin values. Any resource testing PMax or PMin outside of the 9:00 AM to 3:00 PM timeframe and without a Resource Test Administrator present is responsible for ensuring the resource runs for a full thirty minutes, or fifteen minutes for non-generator resources (NGR), at maximum/minimum load. If the Resource Test Administrator does not have a full thirty minutes (or fifteen minutes for NGR) of data available to analyze, the SC will not receive test results. The SC is responsible for ensuring that an active Outage request in the outage management system is in place for the period of the test. If an Outage request is not submitted, the test will not be allowed, and the SC will be required to reschedule the test. An Exceptional Dispatch, if needed, will be issued for the Test Energy delivered during the test of 50 MW or above up to the maximum allowed by the software. If the test is CAISO-initiated, ED should be logged in the ED tool regardless of whether the test energy is above or below 50 MW to allow for BCR settlements.
Testing Response Time and Communication Time	For Non-Regulation tests, the specified test period include the SC and resource operator response time, as well as all communication time. That is, the test period begins with the contact between CAISO and the resource operator to commence testing. For Regulation tests, the specified test period (10 minutes) includes time required for Real-Time and control telemetry to affect change in resource output.
Testing Sequence Considerations	For a resource that requests testing of multiple Ancillary Services and/or values, the sequence of services and/or values tested will be determined by a combination of considerations, including but not limited to: • System conditions, and/or • Resource MW position at the start of the test, and/or • CAISO Generation Dispatcher needs and restrictions; and/or • Preference expressed by the Resource Operator or the CAISO.

Part	Details
Cancellation of Tests by CAISO on the Scheduled Test Day	Resource testing on a Scheduled test day may be cancelled or postponed at the discretion of the CAISO Generation Dispatcher and/or Manager of Balancing Authority (BA) Operations due to system conditions (e.g., Restricted Maintenance Operations, system deficiency, or any other System Emergency). In the event the CAISO cancels a test due to system conditions, the Resource Test Administrator will work with the SC and resource to re-schedule testing at the earliest mutual convenience.
Resource Performance during Testing	The Resource Test Administrator allows a maximum of two resource trips during testing before stopping and canceling the test. If a resource trips during the test due to equipment failure or operating troubles that cannot be remedied promptly, the test will be cancelled. In scheduling a re-test for the resource, the normal test request process will be followed. Any other resource requesting testing within the same time frame as the troubled resource requesting a re-test takes precedence in the testing queue.
Non-Spinning Reserve Testing	A resource that requests Non-Spinning Reserve testing must be tested from shut down and must have the ability within 10 minutes of notification to start, roll to speed and voltage, parallel to the Grid, and load to the requested MW value (as requested in CAISO Operating Procedure 5330A Resource Test Request Form). Any resource with a Start-Up time of more than 10 minutes will not be tested for Non-Spinning Reserves. Once the resource reaches the requested MW, or the MW reached within 10 minutes, it must maintain that output for at least 30-minutes. *This requirement is consistent with NERC Standard BAL-002-3, which requires Contingency Reserves to be fully deployable within the applicable disturbance recovery period.* To facilitate Non-Spinning testing, a resource must provide the following EMS data points: • Resource Terminal Voltage • Generator Circuit Breaker status • Peaker “Ready to Start” • Peaker “Start” The Business Practice Manual for Direct Telemetry provides complete definitions of the required data points. Contact the CAISO via edas@caiso.com with inquiries about the above-referenced points.

Part	Details
Spinning Reserve Testing	The minimum governor or other control system performance for a resource requesting certification for Spinning Reserve must meet the following requirement: • 5 percent droop; • +/- 0.036 Hz deadband; and • Power output change in one second for any frequency deviation outside of the deadband.
Decimal Places	Observed and stated data are recorded to two-decimal place accuracy. Calculations of Ramp Rates are stated and recorded to two decimal place accuracy.
Test Periods	Recording: The calculations performed on the data will be valid if the start and stop times are recorded to the one tenth of a second. If the available operating range of a resource is less than the range that would be covered by a ten-minute ramp, a shorter test period may be used. Test Termination: Ramp Rate test termination is either the end of the specified test time (10 minutes) or the time the resource reaches a limit.
Visibility	Any resource requesting testing must be fully compliant with the applicable CAISO direct telemetry Standards and be visible through telemetry on the CAISO EMS. A System Resource testing for regulation must be fully compliant with the telemetry requirements outlined in the CAISO Standards for Regulation Imports. NGR resources shall provide CAISO with the following additional telemetry data: • Resource Ramp Rate when operating as Generation (MW/min); • Resource Ramp Rate when operating as Load (MW/min); • The maximum instantaneous ability to produce or consume Energy in MW; and • The maximum capability to provide Energy as expressed in MWh over a fifteen (15) minute interval. The Resource Test Administrator confirms resource visibility prior to administering the test and will verify compliance with the applicable CAISO telemetry Standard through the Field Data Acquisition RIG Engineer.

Part	Details
Physical Scheduling of Aggregated Resources	Resources that Schedule and bid as an aggregate will be tested as an aggregate. Direct telemetry is required and must be available for every resource within the aggregation.
RMR Unit Testing RMR Capacity	Generating Units that are under a Reliability Must Run (RMR) contract are tested using this procedure, and can be tested as described in CAISO Tariff Appendix G.
Regulation Requirements	Schedule Requirements during Testing: It is the responsibility of the SC to ensure that there are no Resource Capacity Schedules submitted for the duration of the Regulation testing period as that could cause the cancellation of the scheduled resource test. Response Time Delay: Delayed response time (the time between the resource receiving a control signal indicating a change in set point and the instant the Resource MW output changes) is a significant factor to CAISO reliability. If tests indicate that Regulation is not reliable on certain Generating Units or in specific ranges, Regulation service is not certified on those Generating Units or in those ranges. Symmetrical Regulation Testing: Symmetrical Regulation Up and Regulation Down (Regulation up Ramp Rate and Regulation down Ramp Rate must be equal) values are necessary for proper operation of the CAISO Automatic Generation Control (AGC) system.

Part	Details
Regulation Requirements (Continued)	Total Regulation Up Ramp Rates need to be equal to Total Regulation Down Ramp Rates or control is biased in one direction. Therefore, the single reported "Test Value" for Regulation would be the lesser of the approved Regulation Up and Regulation Down Ramp Rates. ***Notes:*** *As stated in CAISO Tariff Section 8.4.1.1(e), "the resource must be capable of the full range of movement within the amount of Regulation capability offered without manual resource operator intervention of any kind."(i.e., manually turning on or off feed pumps, burner rows, or pairs, duct burners, etc.) Resources that wish to certify within a Regulation range that requires resource manipulation such as that stated above must first implement automatic capability to transition smoothly through operating restrictions without manual intervention and must demonstrate such automatic capability during pre-testing.* *The CAISO has not developed criteria under Part A.1, Appendix K of the CAISO Tariff to grant a temporary exemption from applicable operating characteristics for an Ancillary Service Provider seeking to self-provide regulation or receive a regulation award. The CAISO does not currently anticipate granting such exemptions. If the CAISO develops criteria to grant such an exemption, it will revise this Operating Procedure to include those criteria.*
Non-Generator Resources	The direction of the regulation set point can be bi-directional for resources participating in NGR. Resources participating in Regulation Energy Management (REM) will be tested to validate 15 minutes of continuous regulation delivery in both directions. Resources will be moved via set point issued for AGC in both charge and discharge regulation region. For example: Given that a stored energy limit is 2 MWh, the REM qualified resource must follow set point steps within 15 minutes to deliver 8 MW between -8 MW to 8 MW (full range test). Non-REM resources will be tested full range and should be able to provide regulation for at least an hour. Dispatchable Demand Resource (DDR) resources provide regulation by curtailing load (Regulation Up) or increasing consumption towards base load (Regulation Down).

Part	Details
Proxy Demand Response (PDR) and Reliability Demand Response Resource (RDRR)	PDR and RDRR tests are conducted between the SC and Resource(s) with an approved OMS outage by the CAISO in accordance with CAISO Tariff Section 9.3.6.3. Refer to Section 3.5.

3.1.2 Scheduling the Resource for Testing

Perform the following actions to schedule resource testing:

Scheduling Coordinator (SC)

1. **Submit** a completed 5330A Resource Test Request Form to the CAISO Notifications mailbox (asnotifications@caiso.com). The subject line of the email should follow the format of:

   "TEST REQUEST: [RESOURCE ID] [TEST TYPE] [CONFIGURATION] [SEGMENT]"

   Examples:

RESOURCE ID	TEST TYPE	CONFIGURATION	SEGMENT
ISOGEN_6_UNIT	Spinning Reserve	Resource	1
ISOGEN_6_UNIT	Non-Spinning Reserve	1X1	1
ISOGEN_6_UNIT	Regulation	2X1	2
ISOGEN_6_UNIT	PMin	3X1	3
ISOGEN_6_UNIT	PMax	C1	1
ISO_6_PDRP01	Proxy Demand Response		
ISO_6_RDRR01	Reliability Demand Response Resource		

   The 5330A Resource Test Request Form attachment filename shall follow the following file naming convention:

   "[RESOURCE ID] [TEST TYPE] [CONFIGURATION] [SEGMENT]"

   One form is required per test.

   ***Note**: Submitting an incomplete or inaccurate test request form may delay test scheduling. In addition, CAISO will not accept test forms from any entity other than the SC responsible for the resource.*

CAISO Resource Test Administrator
1. **Try** to accommodate the requested test date, as stated on the Test Request Form, **allowing** a minimum of ten calendar days of lead-time. 2. Upon coordination of the test date and time, • **Send** meeting invite and conference call number to the SC. 3. The following types of tests will be conducted between the hours of 9:00 a.m. to 3:00 p.m., Monday through Friday, excluding holidays and weekends: • Regulation • Spinning Reserve • Non-Spinning Reserve • PMax • PMin ***Note**: When conducting only PMax and PMin testing for a resource, the Scheduling Coordinator, and not the CAISO Resource Test Administrator, is responsible for conducting these tests.*

Scheduling Coordinator
1. **Submit** an Outage request via the outage management system where nature of work is "Unit Testing" using the normal outage timelines before the test start date and time. Refer to CAISO Operating Procedure 3220 Generation Outages. 2. **If** testing for PMax or PMin only, **schedule** the PMax or PMin test between the hours of 1:00 a.m. on Sunday and 3:00 p.m. on Friday. 3. **Submit** a proposed test plan to the Resource Test Administrator (ASNotifications@caiso.com) at least a day prior to the scheduled test. • For those who are not registered to use outage management system, an outage request **can be submitted** to Ops-North-Outage@caiso.com or Ops-South-Outage@caiso.com. ***Note**: If an Outage request is not properly submitted and scheduled by the SC, resource testing will not be permitted*.

CAISO Resource Test Administrator
1. **Contact** the SC and the resource operator, as provided on the 5330A Resource Test Request Form, the day prior to the scheduled resource test to confirm the testing schedule and the details of the test(s) to be performed.

3.2 Resource Testing

When resource testing has been scheduled, and a test plan has been agreed to, the resource is ready to test.

3.2.1 SC Initiated Unit Testing

Scheduling Coordinator (SC)
1. **Submit** an Outage Start Request **via** the outage management system where nature of work is Unit Testing **using** the normal outage timelines before the test start date and time. 2. **Submit** a self-schedule in CAISO market to ensure the resource will be awarded accordingly on the day of the test. 3. During test: **Set** outage card to the availability required by the test. 4. **Utilize** PMin rerate if necessary to keep resource from being dispatched downward by the CAISO market. *(**Note:** PMin rerate must be at least 0.1 MW below the resource availability).* 5. If resource is scheduled, • **Set** availability to the market awarded schedule to avoid resource being dispatched upward by the CAISO market. 6. If unable to schedule resource, • **Get** OK from Generation Dispatcher to start test at specific time and run the test energy as system conditions allow. Exceptional Dispatch will be entered in the ED tool if test energy is 50 MW or above under this scenario. 7. If the test energy is less than 50 MW and the market starts sending the resource some DOTs that do not meet the test requirements, • **Modify** OMS card(s) as necessary. 8. **Notify** the CAISO Generation Dispatcher prior to the test completion time and 9. **Update** Outage card to conclude the test. 10. If resource needs to shut down earlier than Minimum on time, • **End** PMin rerate card and • **Set** availability to zero MW. 11. Once resource is shutdown, • **End** outage card.

CAISO Generation Dispatcher
1. **Give** final approval for testing the resource.

3.2.2 Testing PMax and PMin

Perform the following actions to test the PMax and PMin of a resource:

If the purpose of the PMax Test is to achieve a value greater than what currently reflects in the Master File for the unit, the requesting entity must ensure that the requested test value does not exceed what exists in their interconnection agreement on file with the CAISO for the allowable Net MW output to the grid. If the requested PMax Test value does exceed what is reflected in the interconnection agreement, the PMax test will not be allowed, and the entity must enter the network model build process with New Resource Implementation (NRI).

Contact: NRI@caiso.com for more information.

3.2.2.1 Scheduling Coordinator Conducts Testing

Scheduling Coordinator (SC)
1. **Ask** the resource operator to start test (this is the Test Start Time): • If testing a generator resource, for PMax, ○ **Maintain** maximum output for 30 minutes. • If testing a generator resource, for PMin, ○ **Maintain** minimum output for 30 minutes. 2. **Ask** the resource operator to start test (this is the Test Start Time): • If testing an NGR resource, for PMax, ○ **Maintain** maximum output for 15 minutes. • If testing an NGR resource, for PMin, ○ **Maintain** minimum output for 15 minutes. 3. **Monitor** resource performance during test. 4. **Declare** an end to the timed test (as defined in Step 1). 5. If this is a Resource-conducted off-hours test, • **Notify** the CAISO Generation Dispatcher of test completion and • **Submit** an Outage Request to conclude the test. ○ **Include** the Start and End time of the conducted PMax/PMin test on the Outage Request submitted to end the outage. 6. **Notify** Resource Test Administrator via ASNotifications@caiso.com of the Start and Stop time to analyze for PMin and/or PMax. • **Note** the time by hh:mm:ss.

3.2.2.2 Resource Test Administrator or Generation Dispatcher Conducts Testing

Based on current or anticipated system conditions, or other triggers as appropriate, the CAISO may conduct PMax or PMin testing as per Section 3 of CAISO Tariff 34.11.2.

CAISO Resource Test Administrator/Generation Dispatcher
1. **Ask** the resource operator to start test (this is the Test Start Time): • If testing a generator resource, for PMax, ○ **Maintain** maximum output for 30 minutes. • If testing a generator resource, for PMin, ○ **Maintain** minimum output for 30 minutes. • If testing an NGR resource, for PMax, ○ **Maintain** maximum output for 15 minutes. • If testing an NGR resource, for PMin, ○ **Maintain** minimum output for 15 minutes. ***Note:*** *For NGR resources, PMin can be negative.*

CAISO Resource Test Administrator/Generation Dispatcher
1. **Monitor** resource performance during test. 2. **Declare** an end to the timed test (as defined in Step 1). 3. **Record** end data on Test Sheet. • **Note** the time by hh:mm:ss and • **Record** the MW level to two decimal places.

Note: *If a resource cannot maintain the PMax and PMin value registered in the CAISO Master File for the duration of the test, the Scheduling Coordinator is responsible for submitting an appropriate outage on the unit and/or appropriate updates to the Master File to reflect the physical capability of the unit.*

3.2.3 Testing Regulation Ramp Rate

Perform the following actions when testing the Regulation Ramp Rate of resources; repeat these steps for each configuration for an MSG resource:

CAISO Resource Test Administrator
1. **Ensure**: • The resource is on Regulation (UAGC (Unit Automatic Generation Control) PI point on PI Display indicates a closed status to indicate resource is on AGC).

CAISO Resource Test Administrator

- The resource low and high limits, in EMS, do not hinder the testing range. High and low operating limits can be positive and negative for LESR resources and are negative for DDR resources.

2. **Instruct** resource operator to adjust to upper or lower limit.
3. **Allow** enough capacity for ten minutes of ramping in the stated MW Range.
4. **Ensure** all EMS settings are appropriately set to accommodate test.
5. **Notify** Resource Operator of test start (start time is the time that the Set Point is accepted, as indicated on EMS or PI trend).
6. **Record** Test Start data.
   - **Note** the time by hh:mm:ss and
   - **Record** the MW level to two decimal places.
7. **Record** Ramp start time, which is the time when the first MW change is recorded.
   - **Note** the time by hh:mm:ss and
   - **Record** the MW level to two decimal places.
8. **Monitor** MW level for 10 minutes or until Generating Unit reaches upper or lower Regulation limit.

   ***Note**: A resource will be required to control across entire Regulation range to verify the reliability of the upper and lower limits.*

9. When the timed test is complete, or the limit is reached,
   - **Declare** an end to the test.
10. **Record** Test End data.
    - **Note** the time by hh:mm:ss and
    - **Record** the MW level to two decimal places.
11. If necessary, **repeat** the test.
    - **Note** the length of time between Set Point change and resource response.

      This additional data is used to evaluate the performance and reliability of the resource for Regulation. LESR (Limited Energy Storage Resource) resources should have smooth transition between positive and negative regulation range. No forbidden zone is acceptable within the requested regulation range. DDR resources should follow CAISO AGC instruction to curtail or consume.

3.2.4 Testing Spin, Non-Spin Ramp Rate

Perform the following actions when testing the Resource Spin and Non-Spin Ramp Rate:

CAISO Resource Test Administrator

1. **Communicate** to the Generation Dispatcher or System Operator the parameters of the test
2. **Position** resource starting point for optimum response by allowing enough capacity for ten minutes of ramping at the Stated Ramp Rate.
3. If the testing is for Non-Spin, **start** off-line with resource completely shut down.
   - For Generating Units scheduled as an aggregate, all units within the aggregation must be in an off-line state.
4. If the testing is for Spin:
   - **Start** with resource on-line at or above PMin.
     - For Generating Units scheduled as an aggregation, all units within the aggregation from which Spin capacity is bid must be in an on-line state and each unit within the aggregation must be at or above its PMin.
   - **Verify** with Resource Operator or SC that all units within the aggregation are synchronized to the grid and are at their PMin levels.
   - **Confirm** with the SC that the governor is operational and in service. Do not proceed with the test if either of these conditions is not met.
5. **Ask** the Resource Operator to start the test (this is the Test Start Time) and **increase** the output at the maximum allowable rate until instructed to stop (10 minutes for Spin and Non-Spin), or PMax is reached, or Spin or Non-Spin capacity is reached.
6. **Record** test and ramp start data.
   - **Note** the time by hh:mm:ss and
   - **Record** the MW level to two decimal places.
7. **Maintain** real power level for thirty minutes from the time the resource reaches its full test capacity for Non-Spin tests.
   - For DDR resources, **maintain** output within specified bandwidth.
8. **Monitor** MW level for 10 minutes for Non-Spin, or when Full Range is achieved, or until resource reaches PMax.
9. **Declare** an end to the timed test.
10. **Record** end data.
    - **Note** the time by hh:mm:ss and
    - **Record** the MW level to two decimal places.

CAISO Generation Dispatcher or CAISO System Operator
1. **Record** any SC requested Exceptional Dispatch Instruction in the market ED tool, **using** the relevant Instruction Type from CAISO Operating Procedure 2330C Exceptional Dispatch Instruction Type Codes. 2. If market software is unavailable or if the resource or market ID cannot be in the ED Tool, • **Log** the Dispatch Instruction in the Real-Time Operations logging tool (SLIC), **using** the relevant Instruction Type from CAISO Operating Procedure 2330C Exceptional Dispatch Instruction Type Codes ***Note**: If this Exceptional Dispatch Instruction is SC requested, no verbal instruction is required from the CAISO Operator.*

3.2.5 Resource Tests Completion

Perform the following actions to complete the resource testing:

CAISO Resource Test Administrator
1. **Notify** all parties that testing is complete and to return systems to normal (including removal of artificial Schedule information). 2. **Notify** the CAISO Generation Dispatcher that the testing is complete.

Scheduling Coordinator (SC)
1. **Update** the Outage request in the outage management system **notifying** the CAISO of the end of the test Outage.

CAISO Resource Test Administrator
1. **Complete** the 5330A Resource Test Results Form. • **Record** test results. • **Fill-in** Generator contact name. • **Include** any other pertinent data. 2. **Send** the test results to Operations representative or the appointed subject matter experts (SMEs) for approval.

3.2.6 Calculating Resource Test Results

Perform the following to calculate the results of the test data within one business day after the testing is complete:

CAISO Resource Test Administrator

1. **Enter** all test results as applicable with data from the test PI Trends and **record** the MW level to two decimal places, **including**:
   - Test Start Time
   - Test Start MW
   - Ramp Start Time
   - Ramp Start MW
   - Ramp End Time
   - Ramp End MW
   - Test End Time
   - Test End MW
2. **Calculate** the test results, **using** the data recorded in Step 1:
   - MW Change: {End MW – Start MW} (two decimal places).
   - MW Range: Indicates various test ranges (provided by SC in Test Request form).
   - Stated PMax, PMin, or Ramp Rate: Provided by SC in Test Request form.
   - Approved PMax: Average of recorded levels during the 30-minute test period or 15-minute for NGR (tenths of a MW).
   - Approved PMin: Average of recorded levels during the 30-minute test period or 15-minute for NGR (tenths of a MW).
   - Approved Ramp Rate: {MW change/(End time – Start time)} (two decimal places).

***Notes**:*

For Regulation, Symmetrical Reg Up and Reg Down values are necessary for proper operation of the AGC system. Therefore, the single "Approved Value" for Regulation will be the lesser of Reg Up and Reg Down.

For resources starting offline, Synchronization time to the grid is not included in the Approved Ramp Rate calculation.

- *See following page for image of "Calculated Ramp Rates"*

CAISO Resource Test Administrator

***See** "Calculated Ramp Rates" Image here:*

Calculate ramp rates.

The ramp rate is calculated by the change in MWs divided by the change in time (minutes).

1) $\text{Ramp rate} = \frac{\Delta MW}{\Delta T}$

2) $= \frac{MW_{End} - MW_{Start}}{T(\min_{End} + \sec_{End}) - T(\min_{Start} + \sec_{Start})}$

Where $T(\min_{start} + \sec_{start})$ equals ramp start time measured in minutes and seconds, and $T(\min_{End} + \sec_{End})$ equals ramp end time measured in minutes and seconds.

3) $= \frac{MW_{End} - MW_{Start}}{T(\min_{End} + \sec_{End} * \frac{1\min}{60\sec}) - T(\min_{Start} + \sec_{Start} * \frac{1\min}{60\sec})}$

In order to calculate the ramp rate the time must be in terms of minutes, therefore, seconds has to be converted into fractions of a minute.

4) $= \frac{MW_{End} - MW_{Start}}{T_{End} - T_{Start}}$

Once the seconds have been converted in terms of minutes the equation can be simplified by substituting the following: $T_{start} = T(\min_{start} + \sec_{start})$ and $T_{End} = T(\min_{End} + \sec_{End})$

Calculate Ramp Rates.png

3.2.7 Processing Test Values

Perform the following actions to update all test values in the Resource Data Template (RDT) for the resource:

CAISO Resource Test Administrator
1. **Send** the test results to the appointed subject matter experts (SMEs) for approval.

CAISO System Operations Specialist
1. **Review** the test results and **approve** or **disapprove** the test for certification. • **Provide** feedback if test results are disapproved.

CAISO Resource Test Administrator
1. **Contact** the SC **with** the resource test results. ***Note:*** *Resource test results shall be communicated to the SC via email once it concludes its analysis of test results (which may take up to ten business days).*

Scheduling Coordinator (SC)
1. **Submit** changes to the applicable RDT values according to the test results.

3.3 Curtailable Demand Testing

Curtailable Demand Testing verifies the Scheduling Coordinator's ability to provide Non-Spinning Reserve or Imbalance Energy.

3.3.1 Performing the Curtailable Demand Ramp Rate Test

Perform the following actions to schedule, conduct and evaluate a Curtailable Demand Test:

Scheduling Coordinator (SC)
1. **Contact** the CAISO Resource Test Administrator regarding the proposed Curtailable Demand Test **via** an email to ASNotifications@caiso.com.

CAISO Resource Test Administrator

1. **Discuss** the following with the SC:
   - **Remind** the SC that telemetry must be available from the Curtailable Demand to the CAISO.
   - **Remind** the SC to submit the 5330A Resource Test Request Form.
   - **Remind** the SC to Schedule the test for a peak load time for the Curtailable Demand.
   - **Remind** the SC to include the Resource ID for the Curtailable Demand if there is already a Resource ID designated for the participating load in question on the 5330A Resource Test Request Form.

Scheduling Coordinator (SC)

1. **Submit** a 5330A Resource Test Request Form to ASNotifications@caiso.com at least ten (10) calendar days prior to the desired test date.
   - **Send** any questions to ASNotifications@caiso.com.

   ***Notes**:*
   - *Failure to complete the test form properly or submitting the test form to the CAISO Notifications mailbox will result in a delay in scheduling the test with the Resource Test Administrator.*
   - *Tests for Load Resources that do not have the proper EMS point already set up in the EMS and Master File databases should be scheduled for a date after the next database build.*
2. **Submit** an Outage request **via** the outage management system **using** the "Unit Testing" nature of work.
   - **Refer** to CAISO Operating Procedure 3220 Generation Outages for outage submission timeline.
   - For those who are not registered to use outage management system, an outage request **can be submitted** to Ops-North-Outage@caiso.com and Ops-South-Outage@caiso.com.

   ***Note**: If an Outage request is not properly submitted and scheduled, resource testing will not be permitted.*

CAISO Operations Planning Engineer

1. **Review** and **approve** the outage according to system condition.

CAISO Resource Test Administrator

1. **Schedule** a date/time for the test during a period when the Demand is at or near the maximum level and System Operations can accommodate.
2. **Try to accommodate** the SC's requested date, if possible.

CAISO Resource Test Administrator

3. **Notify** System Operations of the impending Curtailable Demand Test.

ON THE DAY OF THE TEST

1. **Access** the applicable Curtailable Demand EMS point for monitoring purposes.
2. **Ask** the SC to adjust Demand to maximum for controllable Loads otherwise do not raise Demand.
3. **Ask** the SC to curtail Demand at this time (this is the exact start time) to the desired Demand limit.
4. **Record** Test Start data.
   - **Note** the time by hh:mm:ss and
   - **Record** the MW level to two decimal places.
5. **Monitor** MW level for 10 minutes or until Demand is fully curtailed, whichever comes first.

Scheduling Coordinator (SC), CAISO Resource Test Administrator

1. When the timed test is complete or the Limit has been reached,
   - **Declare** an end to the test.

CAISO Resource Test Administrator

1. **Record** Test end data.
   - **Note** the time by hh:mm:ss and
   - **Record** the MW level to two decimal places.
2. **Notify** all parties that testing is complete and to return systems to normal.
3. **Notify** the Generation Dispatcher that testing is complete.

Scheduling Coordinator (SC)

1. **Update** the outage management system Outage request, **notifying** the CAISO of the end of the test Outage.

CAISO Resource Test Administrator

1. **Complete** the Resource Test Results Form.
2. **Record** test results and **include** any other pertinent data.

3.3.2 Calculating Curtailable Demand Test Results

To calculate the Curtailable demand test results, perform the following actions:

CAISO Resource Test Administrator

1. **Enter** all test results, as applicable with data from the test PI Trends and **record** the MW level to two decimal places, **including**:
   - Test Start Time
   - Test Start MW
   - Ramp Start Time
   - Ramp Start Mw
   - Ramp End Time
   - Ramp End MW
   - Test End Time
   - Test End MW
2. **Calculate** the test results, **using** the data recorded in Step 1:
   - MW Change: {End MW – Start MW} (two decimal places)
   - MW Range: Indicates various test ranges (provided by SC in Test Request form)
   - Stated PMax, PMin, or Ramp Rate: Provided by SC in Test Request form
   - Approved Ramp Rate: {MW change/(End time – Start time)} (two decimal places)
3. **Refer** to Step 3 in Section 3.2.6 for information on how to calculate the Ramp Rate.
4. **Send** resource test results to the appointed subject matter experts (SMEs) for approval.

CAISO System Operations Specialist

1. **Review** the test results and **approve** or **disapprove** the test for certification.
2. **Provide** feedback if test results are disapproved.

CAISO Resource Test Administrator

1. **Send** the resource test results to the SC by the end of the next business day following the test.

   Note: *Resource test results may still be subject to CAISO approval.*

3.4 System Resource Testing

***Note**: A System Resource is a group of resources, a single resource, or a portion of a resource located outside the CAISO Balancing Authority, capable of providing Energy and/or AS to the CAISO Controlled Grid. These resources are also called dynamic and pseudo-tie resources and require E-Tags.*

Part	Details
Exceptions for System Resources	For testing purposes, System Resources are dispatched directly through the SC and coordinated with the host Balancing Authority. An E-Tag must accompany the test for dynamic and pseudo-tie resources.
Initial SC/Balancing Authority Testing of Spin and Non-spin Imports	The SC for the System Resource certifies its ability to deliver Spinning Reserve and Non-Spinning Reserve services by completing the 5330D Request for Testing Spinning and Non-Spinning Reserve Imports form. On the form, the SC indicates the amounts deliverable and the points of Interchange. The SC acknowledges that the CAISO Tariff and Protocols require the SC to respond to CAISO Dispatch instructions ordering the delivery of Energy associated with Bid AS either pre-dispatches or at any time during the Operating Hour. The SC further certifies that all AS Bid or self-provided as external Imports of System Resources will be delivered over non-interruptible, non-recallable transmission rights, from the source of the AS to the point of Interchange with the CAISO Balancing Authority. Additionally, the SC must verify that the resource has a governor.
Initial SC/Balancing Authority Testing of Regulation Imports	In submitting the 5330E Request for Testing Imports of Regulation , the SC for the System Resource and its host Balancing Authority jointly request testing for Imports of Regulation from the external System Resource(s) into the CAISO Balancing Authority utilizing the 5330A Resource Test Request Form. On the form, the SC and host Balancing Authority indicate the maximum amounts of regulating Capacity deliverable at specific points of Interchange at which such delivery can be Scheduled into the CAISO. With the testing request, the SC and host Balancing Authority acknowledge that the CAISO Tariff, Protocols, and Standards for Imports of Regulation impose and require certain specific levels of performance. The specific performance requirements include, but are not limited to, the response time of the System Resource to the CAISO's AGC control signals, Ramp Rate, and operating range limitations. The SC and host Balancing Authority further state that Regulation service, whether Bid as

Part	Details
	Imports or self-provided as Imports of System Resources, will be delivered over non-interruptible, non-recallable transmission rights, from the source of the AS to the point of Interchange with the CAISO Balancing Authority.
CAISO Issuance of Test Results	Upon favorable conclusion of the tests and CAISO evaluation of the SC testing and related data, the CAISO shall provide written notification of acceptance of the SC's ability to deliver AS to the points of Interchange with the CAISO Balancing Authority in the amounts indicated in the applicable request form.

3.4.1 System Dynamic Resource Test

Perform the following actions to perform the System Dynamic Resources test for Imported Spinning and Non-Spinning Reserves:

Scheduling Coordinator (SC)
1. **Submit** an Outage request in the outage management system (**within** the parameters provided by the request document, CAISO Operating Procedure 5330D Request for Testing Spinning and Non-Spinning Reserve Imports) 2. **Submit** an E-Tag one hour before the test, • Energy profile must be zero MWh. • Transmission profile must be the highest expected MW output of the resource during the hour (**within** the parameters provided by the request document, CAISO Operating Procedure 5330D Request for Testing Spinning and Non-Spinning Reserve Imports). • When the hour is over, the E-Tag must be **updated** with the integrated MWh amount.

CAISO Generation Dispatcher, CAISO Transmission Dispatcher, CAISO System Operations Coordinator (SOC), CAISO Resource Test Administrator
1. **Review** E-Tag associated with Dynamic Resource Schedule: • If there is no associated E-Tag, **fail** the test. • If there is an E-Tag, **confirm** schedule amounts are within test parameters. 2. **Determine** whether system conditions support test: • **Check** available internal resources to **compensate** for fluctuation of System Resource being tested.

CAISO Generation Dispatcher, CAISO Transmission Dispatcher, CAISO System Operations Coordinator (SOC), CAISO Resource Test Administrator
• **Obtain** final approval for testing from the CAISO Generation Dispatcher and CAISO Manager of BA Operations. 3. **Notify** SC of start time (this contact is the Start Time) and **request** Energy Schedule adjustment effective within ten minutes. (Declaration of test is optional.) 4. **Record** Test Start data, • **Note** the time by hh:mm:ss, and • **Record** the MW level to two decimal places. 5. **Contact** Balancing Authority and **confirm** Energy Schedule adjustment. 6. **End** the test upon successful completion of Energy Schedule adjustment and confirmation of other Balancing Authority. 7. **Record** test end data. • **Note** the time by hh:mm:ss and new Energy Schedule MW level. 8. **Log** tests in SLIC and 9. **Close out** Outage requests in the outage management system. 10. **Notify** all parties that testing is complete and systems should be returned to normal.

3.4.2 Response Test for Imported Regulation Services

Perform the following actions to perform a response test for imported regulation services:

CAISO Generation Dispatcher, CAISO Transmission Dispatcher, CAISO System Operations Coordinator (SOC), CAISO Resource Test Administrator
1. **Review** E-Tag associated with Resource Schedule: • If there is no associated E-Tag, **fail** the test. • If there is an E-Tag, **confirm** Schedule amounts. 2. **Determine** whether system conditions support test: • **Check** available internal resources to **compensate** for fluctuation of System Resource being tested. • **Obtain** final approval for testing from the CAISO Generation Dispatcher. 3. **Position** System Resource at start point for optimum response: • **Allow** enough room for ten minutes of ramping in the Stated Ramp Range, (Preferably, start at bottom or top of Regulation range). 4. **Ensure** the following: • Reg Awards checkbox is checked (Regulation - call up the System>Generation Summary). • System Resource on Regulation. • Resource low and high limits in EMS will not hinder the testing range. • Host Balancing Authority is prepared. • CAISO Reg limits are outside of testing range.

CAISO Generation Dispatcher, CAISO Transmission Dispatcher, CAISO System Operations Coordinator (SOC), CAISO Resource Test Administrator
• "CAISO Ramp Rate" is above Stated Ramp Rate (**see** Unit Control display). 5. **Manually replace** Set Point to a level at least 10 times the Stated Ramp Rate above or below start point. (Start Time is the time that the Set Point is changed, as indicated on EMS or PI trend.) 6. **Record** Test Start data, • **Note** the time by hh:mm:ss, and • **Record** the MW level to two decimal places. 7. **Monitor** MW level for 10 minutes or until System Resource reaches upper or lower Regulation limit.

Scheduling Coordinator (SC), CAISO Resource Test Administrator
1. If timed test is complete, or limit is reached, **call** an end to the test.

CAISO Resource Test Administrator
1. **Record** Test End data of the PI Trend, **showing** MW level and end time, and 2. **Record** time (hh:mm:ss) and MW level (recorded to two decimal places).* 3. **Note** the length of time between Set Point change and System Resource response. This additional data will be used to evaluate the performance and reliability of the System Resource for Regulation. 4. **Log** tests in SLIC and 5. **Close** out Outage cards. 6. **Notify** all parties that testing is complete and systems should be returned to normal. 7. **Complete** at least Test Administrator Name and • **Include** any other recorded data. 8. **Sequence** PI Trends chronologically and • **Note** purpose of each screen-print (e.g., "Begin Reg Up"). ****Note:** *System Resource may be required to control across entire Regulation range to verify the reliability of the upper and lower limits.*

3.4.3 System Resource Test Results Calculations

Calculating System Resource Test Results:

Test data calculation occurs within one business day after the testing is complete. To calculate the results, refer to Section 3.2.6.

3.4.4 System Resource Test Values Processing

Processing System Resource Test Values:

Update all test values in the applicable RDT (refer to Section 3.2.7).

3.5 Proxy Demand Response and Reliability Demand Response Resources

Scheduling Coordinator (SC)

***Note**: Resource must not be in the Market during the proposed testing (i.e., No Day-Ahead Schedule, Real-Time Awards, RUC, etc.).*

1. **Submit** an outage request **via** OMS.
   - The Nature of Work shall be Unit Testing.
   - The Short Description shall indicate PDR/RDRR Self-Test (or something similar in nature to **indicate** the outage is for a self-directed test of either a PDR or RDRR).

   ***Note**: Outages must be made in accordance with CAISO Tariff Section 9.3.6.3 Real-Time outages may be submitted; however, if the Resource is RA, it may be subject to penalties.*
2. **Upon** receiving an outage number, **submit** a 5330A Resource Test Request Form to ASNotifications@caiso.com, **following** the convention outlined in Section 3.1.2.

ON THE DAY OF THE TEST

1. **Submit** an Outage Start Request **via** the outage management system.

CAISO Generation Dispatcher

1. **Give** final approval for testing the resource.

Scheduling Coordinator (SC)

1. **Conduct** the test with the participating Resource(s).
2. **Monitor** resource performance during test.
3. **Notify** the CAISO Generation Dispatcher of test completion and
4. **Submit** an Outage Request to end the outage.
   - **Include** the Start and End Time of the conducted test.
5. **Provide** the Test Results to your Local Regulatory Authority and **copy** the CAISO at ASNotifications@caiso.com.

4. Supporting Information

Operationally Affected Parties

Shared with the Public.

References

Resources studied in the development of this procedure and that may influence some steps taken herein include but are not limited to:

CAISO Tariff	Section 8.3.4, Certification and Testing Requirements. Appendix K Ancillary Service Requirements Protocol (ASRP).
CAISO Operating Procedure	1210 Day-Ahead Market 5330A Resource Test Request Form 5330B Spinning and Non-Spinning Reserve Imports 5330D Request for Testing Spinning and Non-Spinning Reserve Imports 5330E Request for Testing Imports of Regulation
NERC Requirements	EOP-005-3 R10 ; BAL-002-3
WECC Criterion	
Other References	

Definitions

Unless the context otherwise indicates, any word or expression defined in the Master Definitions Supplement to the CAISO Tariff shall have that meaning when capitalized in this Operating Procedure.

The following additional terms are capitalized in this Operating Procedure when used as defined below:

Approved Value	The specific value of PMax, PMin or Ramp Rate used by the CAISO, the SCs, and the resource owners for bidding and Bid validation of AS. Approved values may vary for different AS on a single resource.

Curtailable Demand	Demand from a participating Load that can be curtailed at the direction of the CAISO in the Real-Time Dispatch of the CAISO Controlled Grid.
Start Time	For non-Regulation resource tests, the instant that both the time and the starting point (i.e., start data) are recorded by a PI Trend (and/or flagged on a trend chart) and the test administrator notifies the SC that the test is started. For Regulation tests, the time that the REGULATION Set Point is changed as indicated on EMS or Plant Information system (PI) trend.
Stated PMax	The maximum MW level that a given Resource or System Resource can sustain for a determined period as stated by the resource owner and/or SC on the Resource Test Request.
Stated PMin	The lowest MW level not less than zero that a given Resource or System Resource is capable of sustaining for a determined period of time as stated by the Generator and/or SC on 5330A Resource Test Request Form.
Stated Ramp Rate	The rate at which a resource can increase or decrease output for a particular resource as stated by the resource owner and/or SC on the 5330A Resource Test Request Form. The Stated Ramp Rate may vary for different MW ranges on a given Generating Unit, Curtailable Demand, or System Resource. Ramp Rate is measured in MW/minute.
System Resource	An individual or group of resources located outside the CAISO Balancing Authority capable of providing Energy and/or AS to the CAISO Controlled Grid.
Test Resource	Any Generating Unit, Dispatch able Load, or System Resource that is subject to Unannounced Compliance Testing including aggregated resources.
Approved PMax	The maximum sustainable MW level for a given Resource or System Resource as demonstrated during tests and reflected on the CAISO EMS.
Approved PMin	The lowest sustainable MW level for a given Resource or System Resource as demonstrated during tests and reflected on the CAISO EMS.
Approved Ramp Rate	The rate at which a resource can increase or decrease output for a particular resource as tested and calculated by the CAISO. The Approved Ramp Rate may vary for different MW ranges on a given Generating Unit, Curtailable Demand, or System Resource. Ramp Rate is measured in MW/minute.

Version History

Version	Change	Date
12.0	Periodic Review: Section 3.1.1: For "Non-Spinning Reserve Testing" removed (zero RPM) as it is not necessary. Other minor updates including RMR Unit Capacity procedure reference. Section 3.4: Updated note in beginning. Section 3.5, Scheduling Coordinator Tasks: Minor update to Step 5. Minor format and grammar updates. Removed version history prior to 5-years.	4/16/20
12.1	Periodic Review: Updated from ISO to CAISO throughout. Section 1: Updated Scheduling Coordinator (SC) responsibilities. Section 3.1.1: Expanded content for definition of Reliability Must Run (RMR) Capacity to RMR Units and RMR Capacity and added reference for 5340 for Legacy RMR. Section 3.4: Updated Note and Exceptions for System Resources to include E-Tag requirement. Section 3.4.1: Added E-Tagging instructions, including "Dynamic" within section title and added CAISO Transmission Desk to CAISO task tables. References Section: Removed 1310 procedure since relevant content was included in 1210 procedure and updated NERC and Western Electricity Coordinating Council (WECC) Standard references. Removed history prior to five years. Removed Technical Review and Approval sections for procedures consistency (approvals maintained electronically).	5/18/23
12.2	Replaced Shift Manager with Manager of Real-Time Operations.	9/11/23
12.3	Removed instances of "Legacy RMR" and "Non-Legacy" as this no longer applies. Updated from Generation and Transmission "Desk" to "Dispatcher." Updated Section 1 Responsibilities for Generation Dispatcher, adding new bullet at the end. Minor formatting and removed history prior to five years.	1/01/24
12.4	References: Removed 5340 procedure reference due to retirement on 12/19/24. Minor formatting and grammar edits throughout.	1/23/25
12.5	Replaced Manager of Real-Time Operations with Manager of BA Operations. Corrected typo in Section 3.2.3, Item 11. Defined various terms throughout procedure. Minor grammar edits and removed history prior to five years.	12/18/25

Version	Change	Date
12.6	Periodic Review: Updates made relating to the retirement of BAL-002-WECC, effective July 1, 2026. Minor formatting and grammar edits.	7/01/26

5. Periodic Review Procedure

Review Criteria & Incorporation of Changes

There are no specific criteria for reviewing or changing this document, follow instructions in CAISO Operating Procedure 5510.

Frequency

Every three (3) Years.

Appendix

5330A Resource Test Request Form
5330B Spinning and Non-Spinning Reserve Imports
5330D Request for Testing Spinning and Non-Spinning Reserve Imports
5330E Request for Testing Imports of Regulation

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