COGCC OPERATOR GUIDANCE
MECHANICAL INTEGRITY TEST GUIDANCE: PRACTICES AND PROCEDURES

DOCUMENT CONTROL:

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Background

The purpose of this guidance is to explain key aspects of Colorado Oil and Gas Conservation Commission’s (COGCC’s) rules, regulations, policies, practices, and procedures pertaining to mechanical integrity tests (MITs) for both “idle” oil and gas wells and Class II underground injection control (UIC) wells. **IDLE WELLs**, as discussed in this guidance, include: 1) wells shut-in (SI) longer than two years, 2) wells temporarily abandoned (TA) longer than 30 days, 3) wells with suspended operations (SO) longer than two years, 4) wells waiting-on-completion (WO) longer than two years, and 5) monitor wells not used for hydrocarbon production. Definitions for SI, TA, SO, and WO wells are available in COGCC’s 100-series rules.

Well Types, Production Methods, and Test Frequency

*Tests for UIC Wells*

MITs shall be performed prior to UIC permit approval and prior to commencing initial injection. Thereafter, MITs shall be performed on UIC wells at five (5) year intervals (Rule 326.a.(4)A).

*Tests for Idle Wells*

Idle Wells shall pass an MIT within two (2) years of the initial date when the well status becomes SI, WO, or SO. An Idle Well MIT is required for TA wells within thirty (30) days of temporary abandonment. After the initial MITs described above, subsequent
MITs shall be performed at five (5) year intervals until the well is put on production or plugged and abandoned. Pressure testing may be required for wells prior to returning wells to production (per Rule 317.k.) or prior to plugging and abandonment (per Conditions of Approval on a Well Abandonment Report, Form 6, Notice of Intent to Abandon).

MITs shall be performed on monitoring wells (a.k.a. pressure observation wells) at the initial well set-up and on subsequent MITs at a five (5) year intervals from the date that the well was drilled as a monitoring well or the date that the well was converted to monitoring status. For a monitor well that is being actively used to monitor pressure or seismic activity an operator may by Sundry Form 4 to request approval of an alternate method of defining integrity by presenting the pressure or seismic data as evidence of no internal fluid movement. It is at COGCC engineering staff discretion to request the subsequent MIT.

Tests and Exceptions for Wells with Alternate Production Methods

Operators produce some wells, including lower-producing or lower-pressure wells, using production packers or intermittent swabbing. These production methods may make it difficult to determine casing integrity based on production reporting alone.

Except as noted below for gas lift wells, MITs shall be performed on wells that are produced with a production packer or alternate method of isolation of the production perforations within two (2) years of the date the well was configured with the production packer, then every five (5) years after the initial test.

MITs shall be performed on wells that are produced by swabbing within two (2) years of the initial swab date, then every (5) five years after the initial test.

Tubing-casing annulus packers used for gas lift may or may not seal the casing above the top production perforation. These packers may be used to isolate individual stages of a producing zone (placement below the top perforation), rather than the entire producing zone (placement above the top perforation). MITs are not required for producing wells in this configuration, provided that the operator has documented monitoring in place to detect tubing leaks, casing leaks, and packer leaks. At a minimum, this would involve monitoring tubing, casing, and all annulus pressures and monitoring production efficiency. Upon request by COGCC staff, the operator may be required to provide monitoring records to demonstrate compliance for this exception. Gas lift wells shall remain on production for this exception. If a gas lift well becomes an Idle Well, as defined above, then the well shall pass an Idle Well MIT.
Test Exception for Idle Wells with Open Hole Completions

MITs are not required for SI or TA wells that are configured with fully-cemented, shallow surface casing (setting depth less than or equal to 500 feet) with no intermediate or production casing and an open hole completion below surface casing, provided that the well does not have an open wellbore penetrating other geologic formations underlying the producing zone. Wells with this configuration shall be produced or evaluated for plugging and abandonment within two (2) years of commencing SI status or within thirty (30) days of commencing TA status.

An “evaluation for plugging and abandonment” shall include the following, to be submitted on a Sundry Notice, Form 4:
1) Pressure history for the well for COGCC Engineering staff to evaluate pressure exerted at the surface casing shoe;
2) Written evaluation of operator’s rationale and justification for plugging and abandonment, returning to production, or leaving the well in its current SI or TA state; and,
3) Written statement from any other governmental agencies with jurisdiction for the wellbore (e.g., federal Bureau of Land Management for wells with federal minerals) regarding their opinion on the operator’s future plans for the well.

Test Notification and COGCC Observation of Tests

Form 42 Notification
Operators must submit a Field Operations Notice, Form 42 to notify COGCC staff ten (10) days prior to an MIT (Rule 316B, Rule 316C.f. and Rule 326.e.). If schedule changes necessitate submittal of a Corrected Form 42, operators shall consult procedures shown in “General Instructions for Corrections to Submitted Notices” section of “COGCC Operator Guidance, Rule 316C/Form 42: Field Operations Notice,” available in COGCC’s Operator Guidance section of our website.

COGCC Test Observation – Witnessed MITs

All UIC well MITs shall be witnessed by COGCC Staff.

COGCC Staff observation of Idle Well MITs is at the discretion of COGCC Staff after the operator provides proper notice on a Form 42. Operators should be prepared for COGCC observation of any Idle Well MITs by completing a Mechanical Integrity Test, Form 21 with current wellbore configuration information and providing the completed Form 21 for COGCC Staff in the field prior to performing the test. A complete form shall include appropriate information in the “reasons” section of the form and pre-test well configuration information section of the form (i.e., Injection/Producing Zone(s),
Perforated Interval, etc.). Pressure chart recordings are not required for COGCC-witnessed MITs, but are recommended and helpful for documenting the tests.

The operator should review COGCC guidance for completing the Form 21 prior to the test. Form 21 instructions can be found on the COGCC website Regulation/Form Instructions section: Form 21 Instructions: Mechanical Integrity Test.

While operator electronic eForm submittal of Form 21s is preferred to expedite processing and reduce data entry errors, hard copy submittal of Form 21 is also allowed. If COGCC Staff is present to witness an MIT, the test data results will be filled in on the Form 21 by COGCC Staff. The Form 21 shall be signed by both parties to document the presence of COGCC Staff on location, but the signature does not represent COGCC approval of the form. COGCC Engineering staff reviews and approves or denies approval of the Form 21 after it is submitted by the operator. If used, pressure charts or data should be attached to the form.

**Non-Witnessed MITs**

If an MIT is not witnessed by COGCC, the operator is required to file a Form 21 and an electronic scan or hard copy of an original pressure chart (per Rule 316B) within thirty (30) days of the test. The chart may be a circular recording set with an appropriate rotation rate (e.g., clock rate of one (1) revolution per hour is appropriate) and pressure range. For example, a zero to ten thousand (0-10,000) psi pressure range is not appropriate for a three hundred (300) psi pressure test. The chart should include the pressure run up from zero (0) psi, the test itself, and pressure run down to zero (0) psi. Alternatively, the operator may record test results with a data logger and provide the following to COGCC:

1) Pressure versus Time plot of the test including the pressure run up, the test, and the pressure run down, and

2) A data table containing pressure values at intervals of no more than one (1) minute and no less than fifteen (15) seconds. The Pressure versus Time plot shall have legible axes with scales appropriate for the test pressure and duration of the test.

The test should commence after any pressure fluctuations stabilize (e.g., pressure changes from bleeding air out of the system, pressure changes resulting from temperature effects, or water hammer evident after opening or closing valves). The last 5 minutes of the test shall have a stable pressure reading for a successful test to be approved by COGCC Staff. A stable pressure reading for a digital data logger is defined as +/- 3 psi, which is 1% of the minimum required test pressure per Rule 326.a(1), 326.b(3). and 326.c(3).
General - Mechanical Integrity Test Procedures

**Pre-Test Temperature Stabilization**

To minimize the chance of masking the discovery of a leak because of rapid temperature changes causing fluid expansion or contraction within the tubing-casing annulus configured with a packer or the casing configured with a plug set above perforations, operators shall: 1) Completely fill the casing-tubing annulus or casing with liquid(s) at least twenty-four (24) hours before the test for temperature to reach equilibrium, 2) When possible, pre-test the well before the COGCC Staff arrives on location to avoid unnecessary trips to the field and delays in completing a successful test, 3) Conduct the test only after the wellbore fluid has reached an equilibrium temperature. 4) Allow active injection wells (i.e., UIC wells) to inject continuously or suspend injection for at least twenty-four (24) hours prior to conducting the test.

**Test Duration and Allowable Pressure Changes During the Test**

The test must be at least fifteen (15) minutes long. To pass, the well must not lose or gain more than ten percent (10%) of the initial test pressure (Rule 326.g.), and the pressure must stabilize without an apparent increasing or decreasing trend for the last five (5) minutes of the test. The test may be repeated if the pressure loss or gain is determined to be the result of compression or expansion related to gas dissolution from the fluid column or temperature effects related to the fluid used to load the column. Rising pressures greater than ten percent (10%) in the casing-tubing annulus or casing during a test will invalidate the test, and additional testing shall be performed.

The casing must maintain an ability to maintain 300 psig of differential pressure. For example, if the injection pressure for well operations at 1,200 psig, the test should be run at 1,500 psig. This is computed by starting at the injection pressure of 1,200 psig adding 300 psig (1200 psig + 300 psig = 1,500 psig) to compute a casing-tubing annulus test pressure.

A zero (0) psi initial test pressure is not acceptable. The initial test pressure shall be a minimum of three hundred (300) psig, as defined by per Rule 326.a(1), 326.b(3). and 326.c(3). The well must maintain at least three hundred (300) psig after pressure run up. To meet this objective and allow for a ten percent (10%) pressure decrease during the test, the initial test pressure should be one hundred ten percent (110%) of the nominal test pressure. Therefore it is suggest operators run these low pressure tests at a minimum of 330 psig to allow some pressure decline during the test.

**Isolation Devices and Test Intervals in the Well**

Packers or bridge plugs (isolating devices) must be set one hundred (100) feet or less above the highest injection or production perforation or open hole interval (Rule
326.a.(1)A., Rule 326.b.(3), Rule 326.c.(3), and Form 21 instructions). For horizontal wells the isolation device shall be set in the vertical section of the production casing within one hundred (100) vertical feet of the beginning of the curve into the lateral portion of the well. If a production liner is hung off a larger casing string and the hanger is set above the 100-foot distance above the beginning of the lateral curve, then the isolating device shall be set within one hundred (100) feet of the liner hanger top. For directional wells, the isolating device shall be set within one hundred (100) vertical feet of the top of the perforated or open-hole completion.

If the isolating device is not set as specified above, then the test configuration must be approved by the COGCC Area Engineer BEFORE submitting a ten (10)-day Form 42 notice for the MIT. A Sundry Notice, Form 4 may be required, and depending on the circumstances, a formal Rule 502.b. variance approval may be required.

**Test Intervals for Wells with Stage Cement or Cement Squeeze Remediation**

Wells with stage tools or remedial cement squeezes above injection or production perforations (e.g., cement squeeze of a casing leak) must pass a pressure test to conditions anticipated during completion and/or production operations, consistent with Rule 317.k. (Production and Intermediate Casing Pressure Testing) prior to stimulation and prior to commencing or resuming injection or production. Depending on the expected conditions during stimulation, injection, or production operations, this test pressure may exceed routine MIT pressures for Idle Wells, but the test pressure should not be less than 300 psi, as defined by per Rule 326.a(1), 326.b(3). and 326.c(3).

Perforations or DV tools used for zonal isolation or casing repairs are intended to be sealed with cement, and therefore the repaired casing shall be fully included in the MIT (i.e., repair perforations or squeezed production perforations are not considered production perforations for the purpose of the test and shall be included in the tested interval). If the well is plugged back to a depth above a previously-completed, perforated or open-hole interval, a Completed Interval Report, Form 5A shall be submitted (if not already on file with COGCC) to revise the gross open perforation interval and to abandon a completed formation.

**UIC Wells - Mechanical Integrity Test Procedures**

UIC MITs shall be performed in the same manner as described in the previous section for General Requirements, except that additional considerations are required for UIC wells, as described below.

The initial MIT test performed to fulfill permitting requirements will be the maximum injection pressure to be approved on the UIC permit after the MIT and prior to commencement of injection.
Subsequent MITs shall be performed at a pressure equal to or greater than the average operating injection pressure. At their discretion, prior to or during the test, COGCC staff may require the casing/tubing annulus to be pressurized up to one of the following:

1) the maximum approved injection pressure, as shown on the approved UIC permit (Figure 1);

2) the maximum reported monthly injection pressure following the previous MIT, based on a review of the monthly reported pressure data, which can be found on COGCC’s injection well’s Scout Card (Figure 2).

*Generally, tests will not be run more than three hundred (300) psi above maximum monthly injection pressure.*

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**Figure 1:** Maximum approved injection pressure from the approved UIC permit.
Figure 2: From a review of the monthly reported pressure data found on the injection well Scout Card, the maximum injection pressure can be found on the production data.

The test pressure shall have at least three hundred (300) psi differential pressure between the tubing pressure and the casing-tubing annulus pressure during the test, and the differential pressure shall not drop below three hundred (300) psi during the test, as defined by per Rule 326.a(1), 326.b(3), and 326.c(3).

If the average operating injection pressure is less than three hundred (300) psi, then the test pressure must be three hundred (300) psi plus 10% to allow for pressure decline during the test.

Testing at the average operating pressure will not result in a change in the COGCC-approved maximum injection pressure.

Repairing or replacing the tubing or packer in a UIC well does not require prior approval, but an MIT is required to test the new configuration prior to resuming injection. Any activities involving alteration of casing or cement configuration requires prior approval and will also require an MIT after the repairs are completed and prior to resuming injection. The repair or replacement should be described on Form 21 for Verification of Repairs, and a new Drilling Completion Report, Form 5 may be required by Rule 308A for the change of wellbore configuration.
**Mechanical Integrity Failures and Enforcement**

A leak in wellhead seals, casing, tubing, or packer indicates a loss of mechanical integrity, which is considered a violation of Rule 326.f.

A decrease or increase in test pressure of greater than ten percent (10%) during the fifteen (15) minutes of the MIT or the inability to stabilize the pressure within the last five (5) minutes of the MIT shall constitute a failure. Tubing and casing mechanical integrity shall be maintained in all UIC wells and wells using Alternate Production Methods; casing integrity shall be maintained in all Idle Wells. Failure to maintain mechanical integrity shall be considered a violation of Rule 326.f. Potential enforcement associated with mechanical integrity is described in “COGCC Operator Guidance, Rules 319 and 326: Mechanical Integrity Guidance,” available in COGCC’s Operator Guidance section of our website.

All wells lacking integrity shall be repaired and re-tested or plugged and abandoned. Timeframes and potential enforcement for repair, plugging and abandonment are discussed in “COGCC Operator Guidance, Rules 319 and 326: Mechanical Integrity Guidance.” Prior approval via a Sundry Notice, Form 4 for casing repair (Rule 317.e.) or a Well Abandonment Report, Form 6, Notice of Intent to Abandon (Rule 311) is required.

Upon discovery, all injection wells lacking mechanical integrity shall be shut in immediately (Rule 326.f.(2)). The operator shall notify COGCC staff of any leak as soon as practicable.

**Offset Well Safety Shut-In/Temporary Abandonment**

COGCC Staff acknowledges that operators may perform a safety SI or TA of offset wells in preparation for stimulation of other adjacent well(s). The safety SI or TA wells may be on the same well pad or on a pad in the area. An operator may choose to prepare an adjacent well for safety SI or TA for a variety of downhole or surface issues. Example, it may be necessary to place equipment above the well being SI or TA on the same pad. Further, COGCC Staff understands that some wellhead equipment may be temporarily removed for safety reasons. Many of these temporary conditions would be considered placing the well in a TA well status. Rule 319.b. requires wells to have an MIT performed when wells are TA’d. The following provides guidance for wells that are SI or TA for offset stimulation to keep operators in compliance with COGCC Rules, and identify these wells in the field to assist COGCC Field Inspectors when determining the correct status of wells during their field inspections.

1) When the well is, or wells are, readied for safety SI/TA, document test pressure, test duration, and the depth of the isolating device in the casing of the SI/TA well. A charted or COGCC-witnessed test is not necessary, unless Item #2 applies (see below).
2) If a well has been SI prior to being readied for safety SI/TA and the resulting time before returning to production will be greater than 2 years, perform a charted or COGCC-witnessed MIT and submit the appropriate Form 21 (10-day Form 42 notification required).

3) If a well will be TA for a period greater than 6 months (removal of surface equipment or setting a downhole plug to render the well incapable of production), file a Sundry Notice, Form 4 with all details required by Rule 319.b. Document that there was a pressure test in lieu of a formal MIT prior to temporarily abandoning the well; include statements regarding future plans for the well and how the well is shut to the atmosphere. If the well will be TA with downhole plugs for longer than 60 days, a Completed Interval Report, Form 5A must be filed so that the Operator’s Monthly Report of Operations, Form 7 is consistent with the correct wellbore configuration.

4) Install signage on the SI/TA wellhead indicating the reason for equipment removal (Figure 3). If an operator does not place signage on a well during a Safety SI/TA to alert COGCC’s Field Inspectors, Field Inspection Reports citing MIT corrective actions may result, requiring formal MITs.

5) Failure to perform the requirements as set forth in #2 and #3 above may be considered a violation of COGCC rules.

![Figure 3: Example Temporary Sign](image)

**References** (available on COGCC’s website)

1. Mechanical Integrity Test, Form 21 instructions
2. COGCC Operator Guidance, Rule 316C/Form 42: Field Operations Notice
3. COGCC Operator Guidance, Rules 319 and 326: Mechanical Integrity Guidance

**Guidance Disclaimer**

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Document Change Log

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<td>July 6, 2014</td>
<td>Added suspended operations and waiting-on-completions well narrative, pressure testing after repaired casing</td>
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<tr>
<td>September 15, 2015</td>
<td>Revised language related to January 2015 Rulemaking to add suspended operations and waiting-on-completions to definitions and Rule 326, plus added Offset Well Safety Shut-In/Temporary Abandonment section. Add the section for Test for Idle Wells with Open Hole Completions.</td>
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| May 5, 2016       | Reorganized for clarity and removed duplicate references. Added the Rule reference to Rule 326.a(1), 326.b(3). and 326.c(3) Added the +/-3% psi definition for stable digital pressure measurements. Corrected the wording to page 4 paragraph starting with “Packers or bridge plugs”. Included DV tool to the discussion regarding long string squeeze cement. Add examples for reference.
Examples

Chart with a proper scale: this chart shows pressure run up and run down; show a stable pressure for the length of the test.

Chart with poor scaling: With a poorly scaled chart (pressure scale and time rotation) it is difficult to validate test results and confirm casing integrity.
Graph with no pressure stabilization:

### Data Collection Report

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![Graph showing pressure rising with 70 psi increase (greater than 10% of starting pressure)](image_url)

Chart showing pressure rising with 70 psi increase (greater than 10% of starting pressure):
Packer depth is not within 100 feet of the perforations (needs prior approval):

4190-3988 = 202 feet

### Wellbore Data at Time of Test

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### Tubing Casing/Annulus Test

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