

**STATE OF OHIO
DEPARTMENT OF TRANSPORTATION**

**SUPPLEMENT 1027
AIR COOLED BLAST FURNACE SLAG MATERIAL
CONTROL AND ACCEPTANCE TESTING FOR
ITEMS 203, 204, 304, 410, 411, 503, 518, 611, 617, 850 AND 851**

December 31, 2012

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1027.01 Description. Air cooled blast furnace slag used in construction Items 304, 410, 411, 518, 617, 850 and 851 will conform to the quality control requirements, sampling, testing and acceptance levels of this supplement.

Air cooled blast furnace slag used in construction Items 203, 204, 503 and 611 will conform to the quality control requirements, sampling, testing and acceptance levels of this supplement and the special requirements listed in Appendix A.

1027.02 Slag Supplier Quality Control Plan Requirements. Provide slag materials through a Supplement 1069 Quality Control Plan. Include in the quality control plan the following additional requirements :

A. Quality Control Plan will detail stockpile management processes including:

1. Maintaining site maps of the slag suppliers facility defining all stockpile locations. Define a sequential numbering system for the stockpiles.
 - a. Size of surge pile(s).
 - b. Size of production stockpile (s).
2. Location of where the samples were taken for gradation (S 1069) from each stockpile.
3. Location where samples were taken from the stockpiles for leachate testing 1027.04.
4. How failing tests are distinguished from passing tests in the production stockpile.

5. Define and use a sequential numbering system that will identify the sample to the stockpile or the subplot location in the stockpile. Ensure the numbering system will also identify any resamples.

B. The QCP will define how the supplier will provide a monthly summary of test results conforming to this supplement to both the Office of Materials Management (OMM) and the Home District. Suppliers may provide those results in electronic format and send by e-mail. The Department will approve the electronic format.

C. The QCP will define how the supplier will document a stockpile's quantity, date of construction, location of the stockpile, and general chemistry of stockpile material, sample identification number(s), date of sampling, sample's test results, gradation results, retests and results, and testing technician.

The supplier will maintain documentation for at least 5 years on materials supplied to ODOT. The supplier will provide a yearly report of all test results for materials furnished to ODOT.

D. Furnish testing equipment for performing this supplement's tests. Bring testing equipment to OMM and perform side by side testing to validate testing equipment. If purchasing new testing equipment, have the new equipment validated with OMM prior to testing any material.

E. Document in the QCP the calibration process used to verify equipment is accurate.

F. Participate in all OMM required round robin tests and furnish results to OMM, Aggregate Section.

G. Define in the QCP methods to identify slag materials not conforming to this supplement and ensure those materials are not supplied to ODOT.

Submit the QCP to OMM and the Home District for Acceptance.

1027.03 Sampling Procedure. Suppliers will obtain samples for tests listed in 1027.04 as follows:

The Supplier will sample slag after the materials have been produced to the required gradation. A sample of 80 to 100 pounds (35 to 45 kg) will be obtained for each 2000 tons (906 metric tons) stockpile. Reduce the sample by quartering or splitting to provide a test sample of 20 to 25 pounds (9 to 11 kg).

The supplier may construct stockpiles larger than 2000 tons if the slag's documented chemistry shows the slag material to be stockpiled together is uniform, consistent, from the same steel source and production type. Exclusive of stockpile size, the supplier will sample and test for each 2000 tons (906 metric tons) of production.

When sampling from stockpiles greater than 2000 tons (906 metric tons), a subplot system will be used. Do not construct stockpiles greater than 2000 tons without the documentation of 1027.02.C and demonstrating to the Department the materials in the stockpile are of same origin and similar chemistry.

1027.04 Sulfur Leachate Tests, Procedures and Acceptance Criteria. Provide slag materials conforming to following requirements:

	Acceptance Level	Testing Procedure	Precision acceptance level	Retest Level
A.	No leachate water from a test sample will have an observable color equal to or darker than moderate greenish yellow (hue 10Y 7/4 (10Y = Hue, 7 = Value [Lightness], 4 = Chroma [Saturation]) during the 15 days of the test except - as specified in 1027.08	Visual comparison using the rock color chart distributed by the Geological Society of America	None	None
B.	Leachate water will have a pH between 9.0 and 6.5 at 15 days when tested per 1027.06	Test Procedure AWWA 4510	0.2 above or below the acceptance level	0.3 above or below the acceptance level
C.	Leachate water will have a conductivity result less than 2400 µmho/cm at 15 days when tested per 1027.06	Test Procedure AWWA 2510	50 µmho/cm above the acceptance level	100 µmho/cm above the acceptance level
D.	Leachate water will have a total dissolved solid result of less than 1500 mg/L after 15 days when tested per 1027.06	Test Procedure AWWA 2540 C	75 mg/L above the acceptance level	100 mg/L above the acceptance level

1027.05 Sulfur Leachate Sample Equipment. Minimum sample preparation and testing equipment needed:

- A. A five-gallon (19 L) bucket for soaking the sample.
- B. Filter paper for filtering the water.
- C. A funnel through which to filter the water.
- D. A glass container for observing the water.
- E. A rock color chart. This chart is used for color comparisons and is distributed by the Geological Society of America.
- F. Distilled water with a tested pH between 6.7 to 7.3.
- G. Suitable testing equipment to measure pH, conductivity and total dissolved solids meeting the AWWA procedure.

1027.06 Sulfur Leachate Sample Test Procedure. Suppliers will follow the following test procedure:

- A. Fill sample buckets half full of distilled water. Let the water stand for 1 hour.
- B. Place the slag sample from 1027.03 into the bucket and ensure approximately 1 inch (25 mm) of water is above the top of the slag sample. Soak the sample for 24 hours and then hand or mechanically agitate the water and slag. Pour off 100 ml of slag water and filter the water sample with filter paper. Compare the color of the filtered water sample to the rock chart moderate greenish yellow (hue 10Y). If the water sample's color is equal or darker, the sample is rejected (see 1027.04A). Record the results.
- C. If the sample passes the 24 hour water test, check the water level is still 1 inch (25 mm) above the slag in the bucket and add additional distilled water if needed. Soak the sample and repeat the agitation, water sampling, filtering procedure, and color tests at intervals of 48 hours, 7 days, and 15 days. Check the color each time and record the results. If the sample passes each time period's color test, obtain a water sample conforming to 1027.06D. If any test sample has a color equal or darker than moderate greenish yellow (hue 10Y), the sample is rejected. Record all results.
- D. Obtain a 100 ml sample of the un-diluted 15 day water and filter the water sample with filter paper. Dilute the 100 ml 15 day water sample with 200 ml of distilled water. Mix the 300 ml solution. Test the diluted solution for pH, conductivity and total solids following procedures listed in 1027.04B, C and D.

Record all results of the diluted water sample tests as follows:

Test	Report
Bucket Test	Color hue and number matching the rock color chart for each time period
pH	To the nearest 0.1
Conductivity	To the nearest 1 μ mho/cm
Total Solids	To the nearest mg/l

Stockpile subplot materials or stockpiles not meeting the acceptance levels in 1027.04 are rejected. If test results fall in the precision range the materials the samples represent are acceptable. If the original diluted test results are in the retest level of 1027.04, the supplier will perform retests (see 1027.07). For materials to be acceptable retest results will conform to 1027.04.

1027.07 Stockpile Retesting

- A. Standard retest procedure

Supplier stockpiles that include materials that failed this supplements tests will be reworked with a front end loader and the stockpile soaked down with enough water so the material is 2 percent above saturated surface dry. The supplier will record the date of reworking and soaking.

The reworked stockpiles will not be sampled for at least two months. After two months, the supplier will pull resamples for each 1000 tons of stockpile material. Resampling procedures will conform to 1027.03.

B. Retesting procedures and results

Suppliers will test resamples conforming to 1027.06. If any resample fails, the stockpile material is not accepted. Un-acceptable stockpiles will be reworked, resoaked and aged conforming to 1027.07A before any resamples.

C. Optional pH retest procedure (if pretesting was completed)

A supplier with materials that only failed the pH acceptance level may just retest for pH before actual shipment of the material and not rework the stockpiles conforming to 1027.07A. Only use this option if the following correlation test has been done.

1. Correlation test

Obtain 5 random slag samples conforming to 1027.03. After quartering each of the samples, place the quartered portion of the sample into a bucket and fill with distilled water to 1 inch above the slag sample. Mix each slag and water sample for ten minutes. Allow to sit for 1 hour. Obtain a 100 ml sample of each of the five (5) sample buckets. Dilute each sample with 200 ml. Test each sample for pH using AWWA 4510. Record the results.

Treat the five (5) slag and water samples the same as defined 1027.06.C. At 15 days pull a separate 100 ml water sample from each of the five (5) buckets. Add 200 ml to each sample. Test each sample for pH following AWWA 4510. Record the results.

Average the five(5) 15 day results. = pH (15).

Average the five(5) 1 hour results. = pH(1 hr).

Divide pH(15)/pH(1hr) = pH(c) Record the value.

2. Actual pH retests

For any stockpile sample that failed on pH, pull a new sample from the same stockpile location following 1027.03. Quarter the sample and place the quarter into a bucket. Add distilled water until the slag sample has 1 inch of water above it. Mix the slag and water sample. Let the sample sit for 1 hour. Obtain a 100 ml sample from the bucket. Dilute the sample with 200 ml of distilled water. Test the sample for pH. Multiply the sample pH by pH(c). [pH(s) x pH(c) = pH(retest)]. If the pH(retest) meets 1027.04 requirements for pH the sample is acceptable. Record the value with the original tests for color, conductivity and total solids. Record the date of the pH optional test.

1027.08 Test Frequency Variables. Suppliers with 10 consecutive color tests passing the 24 hr, 48 hr, 7 and 15 day color tests may eliminate the 15 day test. The test results for pH, conductivity and dissolved solids will meet 1027.04 and be performed on 7 day old water samples. Follow the procedure in 1027.06 for testing diluted water samples.

If after eliminating the 15 day tests any 24 hr, 48 hr, or 7 day color tests fail, the stockpile is rejected and the supplier will again resume the 15 day test. Only eliminate the 15 day test when at least 10 consecutive 24 hr, 48 hr, 7 and 15 day color tests again all pass.

1027.09 Slag Supplier Nonconformance to Specifications. Any supplier shipping untested and unreported air cooled blast furnace materials will be removed from the Department's acceptance and Supplement 1069 programs for all items listed herein.

Any supplier found to be providing falsified data will be removed from the Department's acceptance and Supplement 1069 programs for that source.

Any supplier who loses identification of tested and reported tests to materials stockpiles will be placed on probation. Probation will include:

1. Loss of ability to ship material until all documentation is provided the Department and an inspection of the material stockpiles is made to verify identification.
2. Hiring of a private test laboratory to:
 - a. Obtain samples and track complete chain of custody on the samples.
 - b. Test samples.
 - c. Certify the sample results.
 - d. Identify what material stockpiles are approved and can be shipped from.
 - e. Document the results to the Department.
 - f. Document that the shipments of materials were from approved stockpiles.

Any supplier found not performing the tests correctly will be moved to probation as defined in 1027.09.

1027.10 Appeals Process. A supplier may request a hearing before an appeals board when being placed on probation status.

The supplier will request a hearing within 15 days of receiving the notification of probation. The request will be in writing; state the reason for the appeal, and any provide supporting documentation.

The Department will hold an appeals hearing within 30 days of receiving the request.

The appeals board is composed of a representative from the Offices of Materials Management, the Department's State Construction Engineer, and the Deputy Director of the Division of Construction Management.

The appeal hearing will allow the supplier to present their position and time for the Department to provide their position to the board. The appeal board members will determine when the hearing is completed.

The appeal board will issue their findings within 15 days of the date of the hearing.

Appendix A Special Requirements for 203, 204, 503 and 611 Materials

Slag materials can have both short and long term environmental problems, when used in locations where water has long term access to the material.

Because of these issues and environmental concerns the use of slag materials in 203, 204, 503 or 611 applications includes the following additional requirements to Supplement 1027.

A. The owner of the slag source request in writing the Department evaluate if the slag may be used in 203, 204, 503 or 611 applications.

B. The evaluation process will include:

1. If the Department has a previous history with the slag source having environmental issues the request will be denied.
2. If the Department has no previous history the slag source owner will provide exact locations of all sites where the slag has been used in Item 203, 204, 503 and 611 applications. The documentation will include when the material was installed; the slag material tests in conformance with S 1027 or previous historic slag effluent test procedures; and the chemistry of the slag material that was used in the exact location.
3. Department personnel will investigate all sites for signs of slag environmental issues and will interview local land owners to discuss their experiences.
4. If the Department determines that all sites have not exhibited environmental compliance issues the Department will notify the slag source owner.

C. If the Department has a previous history with the slag source but the slag source can demonstrate a change in the chemistry or physical property that renders the slag source environmentally benign, the evaluation process will include Appendix A B.2-B.4.

D. If the Department initially accepts the slag source, the owner will modify their Supplement 1069 Quality control plan to include:

1. Which material applications they will supply (203, 204, 503 and 611).
2. All quality controls they will use for those material types such as:
 - a. Testing frequency for those materials.
 - b. Stockpiling methods.
 - c. The required chemical range of the source of those materials.
 - d. Methods to evaluate the chemical range of the stockpiled materials and compare to the required chemical range of the material.
 - e. Methods to dispose of slag materials not falling within the required chemical range.
 - f. Reporting to the District and the Department of any sample that fails the required testing of this supplement, the appendix and the approved Supplement 1069 quality control plan.