

# Portland Cement Samples 177 & 178

## Please Note:

- Portland Cements No. 177 and No. 178 are both ASTM C150 Type I/II cements with limestone additions.
  - The CO<sub>2</sub> content in limestone of cement no. 177 is 41%
  - The CO<sub>2</sub> content in limestone of cement no. 178 is 39%
- Perform fineness tests on cement taken from the 7,800 g sample.
- You may now submit test results for ASTM 1702 Heat of Hydration by Isothermal Conduction Calorimetry.
- If the ASTM Reference Method is not used to determine the LOI, briefly describe the method used.
- **IMPORTANT!! Data Entry Confirmation** - After you successfully submit test results on the CCRL website you will receive a confirmation screen and a confirmation email sent to the email provided on the data entry page.
- If you did not receive data entry confirmation visit [“Trouble Data Entry Trouble Shooting”](#) or contact CCRL at 301-975-6704.
- Please allow until July 16<sup>th</sup> for receipt of samples.
- Closing date for test results is August 20<sup>th</sup> (August 27<sup>th</sup> for 28-day results).



July 2, 2010

**TO: Participants in the CCRL Portland Cement Proficiency Sample Program**

**SUBJECT: Portland Cement Proficiency Samples No. 177 and No. 178**

The current pair of samples in the Portland Cement Proficiency Sample Program have been sent to your laboratory. The samples for the physical tests are packaged in plastic bags and weigh approximately 7800 grams each. The samples for chemical analysis are in glass vials and weigh approximately 30 grams each. **Both cements are Type I/II with limestone addition.**

**Please allow until July 16, 2010 for receipt of these samples.** If the samples have not been received on this date or if the samples you receive are damaged, notify us by sending email to [ccrl@nist.gov](mailto:ccrl@nist.gov) or by calling 301-975-6704. Replacement samples will be forwarded.

Instructions covering the proposed tests, and the necessary data sheets for reporting the test results are on the following pages. Read these carefully before testing.

**Chemical Tests:** If the ASTM Reference Method is not used to determine Loss on Ignition (LOI), briefly describe the method used.

**Physical Tests:** You may now report test results for ASTM C1702 Heat of Hydration by Isothermal Conduction Calorimetry.

Each sample should be tested separately. The tests should be made as soon as possible, and the results should be promptly submitted upon completion. Test results should be entered at our website: <http://www.ccrl.us/>. The closing date for test results submitted through our website will be August 20, 2010. The results for 28-day tests will be accepted until August 27, 2010. You will receive notice and information by email when the final report is available at our website.

Additional samples of this sample pair and past CCRL samples are available for sale. These samples can be used for research, technician training, and test equipment verification. Contact us for availability and pricing.

Sincerely

Robin K. Haupt  
Supervisor, PSP  
Cement and Concrete Reference Laboratory

## INSTRUCTIONS FOR TESTING

The two samples for the physical tests are packaged in plastic bags, each of which contains approximately 7800 grams of cement. The two samples for chemical analyses (two additional samples are included for laboratories receiving “secondary” chemical samples) are sealed in glass vials, each of which contains approximately 30 grams of cement. The physical and chemical samples for the odd numbered sample represent one cement, and the physical and chemical samples for the even numbered sample represent another cement. The odd and even numbered samples should not be combined. **The odd numbered sample (no. 177) is Type I/II cement with limestone addition, and the even numbered sample (no. 178) is Type I/II cement with limestone addition.** In order to eliminate unnecessary variations in test results, one operator should perform a test method on both samples on the same day.

### PHYSICAL TESTS

Prior to testing, pass the cement for the physical tests through a No. 20 sieve in accordance with ASTM Specification C183.

Perform fineness tests on cement taken from the 7,800 g sample.

Insofar as your laboratory is prepared to do so, perform the following physical tests on each sample in accordance with the current ASTM methods designated below.

Normal Consistency .....	ASTM C187-04
Time of Setting, Vicat .....	ASTM C191-08
Time of Setting, Gillmore .....	ASTM C266-08
Soundness, Autoclave .....	ASTM C151-09
Air Content .....	ASTM C185-08
Compressive Strength (nine cube batch; 3, 7, and 28 day) .....	ASTM C109-08
Fineness, Air Permeability .....	ASTM C204-07
Fineness, Wagner Turbidimeter .....	ASTM C115-96a
Fineness, by the 45 µm (No. 325) Sieve .....	ASTM C430-08
False Set Test (Paste Method) .....	ASTM C451-08
Expansion of Portland Cement Mortar Bars in Water .....	ASTM C1038-04
Heat of Hydration .....	ASTM C186-05
Heat of Hydration by Isothermal Conduction Calorimetry .....	ASTM C1702- 09

It is preferred that the one operator make the physical tests on both samples, on the same day.

## CHEMICAL TESTS

Perform the following chemical tests in accordance with ASTM C114-09 and ASTM C150-07 on each sample. There are two chemical analysis programs. The "Primary Chemical Analysis" program is the laboratory's "best effort" and should be the method used to qualify cement, or test cement for acceptance or rejection. A "Secondary Chemical Analysis" program is also available for laboratories that want to submit a second set of results. For more information about the two chemical analysis programs please read "Information on CCRL Chemical Analysis Program" included with the following pages.

Silicon dioxide,	SiO <sub>2</sub>	Manganic oxide,	Mn <sub>2</sub> O <sub>3</sub>
Aluminum oxide,	Al <sub>2</sub> O <sub>3</sub>	Zinc oxide,	ZnO
Ferric oxide,	Fe <sub>2</sub> O <sub>3</sub>	Chloride,	Cl
Calcium oxide,	CaO	Chromium oxide,	Cr <sub>2</sub> O <sub>3</sub>
Free calcium oxide (free lime )		Carbon dioxide,	CO <sub>2</sub>
Magnesium oxide,	MgO	Limestone content of portland cement <sup>1</sup>	
Sulfur trioxide,	SO <sub>3</sub>	Tricalcium silicate <sup>1</sup> ,	C <sub>3</sub> S
Loss on ignition		Dicalcium silicate <sup>1</sup> ,	C <sub>2</sub> S
Insoluble residue		Tricalcium aluminate <sup>1</sup> ,	C <sub>3</sub> A
Potassium oxide,	K <sub>2</sub> O	Tetracalcium aluminoferrite <sup>1</sup> ,	C <sub>4</sub> A.
Phosphorus pentoxide,	P <sub>2</sub> O <sub>5</sub>		
Titanium dioxide,	TiO <sub>2</sub>		
Sodium oxide,	Na <sub>2</sub> O		

<sup>1</sup> value calculated as shown in annex A2 of ASTM C150-07

It is preferred that one chemist make the chemical tests on both samples, on the same day. The results of a single determination should be reported rather than the average result of duplicate determinations.

**IMPORTANT NOTE: You are now asked to indicate if the XRF instrument was energy dispersive or wavelength dispersive. And what type of XRF sample preparation, glass disk or pressed powder, was used.**

## INSTRUCTIONS FOR REPORTING

For the sake of uniformity, report the values for the various tests to the nearest significant number indicated on the reporting forms. Be sure to indicate what chemical analysis procedure was used.

Test results should be entered at our website: <http://www.ccrl.us/>. The closing date for test results submitted through our website will be August 20, 2010. The results for 28-day tests will be accepted until August 27, 2010.

**CEMENT AND CONCRETE REFERENCE LABORATORY  
PORTLAND CEMENT PROFICIENCY SAMPLE PROGRAM**

**INFORMATION ON CHEMICAL ANALYSIS PROGRAM**

The chemical program consist of a "Primary" analysis program and a supplemental "Secondary" analysis program. The "Primary" is the main chemical analysis report. Test results reported as primary analysis must be results a laboratory used to qualify cement, or test cement for acceptance or rejection. Any method of analysis (wet, x-ray, AA, etc.) is acceptable. This analysis represents a laboratory's best effort and will be used to judge the laboratory's testing proficiency.

A supplementary "Secondary" analysis is also available for laboratories that want to report a second set of test results. This secondary analysis could be performed by a second technician or analyzed by a different method. Each laboratory's "secondary" analysis would be compared to statistical values from the "primary" analysis to assign their laboratory ratings. A laboratory must participate in the "Primary" analysis to be eligible to participate in the "Secondary" analysis.

If your laboratory is not currently receiving a "Secondary" chemical analysis sample and would like to participate in this program you may do one of the following: 1) subscribe to receive future samples (including the current pair) or, 2) you may request just the current pair of samples. To enroll select one of the options by checking the appropriate box, complete laboratory information, include payment for the amount indicated, and return to CCRL. Contact us if you have any questions.

NOTE: **Do not complete this form** if your laboratory currently receives the Secondary Analysis Chemical Report.

Check the appropriate box:

- Send a report for the "Secondary Chemical Analysis" of the current pair of samples only (\$85.00) for the June 2010 samples).

Company \_\_\_\_\_

Location \_\_\_\_\_

CCRL lab number \_\_\_\_\_

Requested by \_\_\_\_\_

Date \_\_\_\_\_

Phone: \_\_\_\_\_ Email: \_\_\_\_\_

RETURN TO:

R. K. Haupt, Supervisor, PSP  
Cement and Concrete Reference Laboratory  
National Institute of Standards and Technology  
100 Bureau Drive, Stop 8618  
Gaithersburg, Maryland 20899-8618  
fax: 301-975-2243

**CCRL PROFICIENCY SAMPLE PROGRAM  
 PORTLAND CEMENT SAMPLES NO. 177 AND NO. 178  
 PRIMARY CHEMICAL ANALYSIS REPORT FORM**

RETURN TO: R.K. Haupt, Supervisor, PSP  
 Cement and Concrete Reference Laboratory  
 National Institute of Standards and Technology  
 100 Bureau Drive, Stop 8618  
 Gaithersburg, Maryland 20899-8618  
 FAX: 301-975-2243

FROM: \_\_\_\_\_  
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 \_\_\_\_\_  
 e-mail: \_\_\_\_\_  
*Check here if name or address has changed* \_\_\_\_\_

**PRIMARY CHEMICAL ANALYSIS**

NOTE: Test results reported on this form should be the laboratory's "best effort". The method used should be the method used to qualify cement, or test cement for acceptance or rejection. More information about this program and the Secondary Analysis program is available on the page titled "Information on CCRL Chemical Analysis Program".

	Sample No. 177	Sample No. 178	Test ID	X-ray *	ASTM Alternate Wet Method	ASTM Reference Wet Method	A.A.	Other (specify)
Report values below to nearest 0.01%				Check the method used				
Silicon dioxide, SiO <sub>2</sub>			10	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Aluminum oxide, Al <sub>2</sub> O <sub>3</sub>			21	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Ferric oxide, Fe <sub>2</sub> O <sub>3</sub>			30	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Calcium oxide, CaO			40	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Free Calcium oxide			41	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Magnesium oxide, MgO			50	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Sulfur trioxide, SO <sub>3</sub>			60	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Loss on ignition			70	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Briefly describe LOI procedure:								
Insoluble residue			80	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Potassium oxide, K <sub>2</sub> O			100	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Titanium dioxide, TiO <sub>2</sub>			103	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<p><b>*Please provide the following information the XRF equipment used for these results.</b></p> <p>XRF instrument:    <input type="checkbox"/> energy dispersive                      <input type="checkbox"/> wavelength dispersive</p> <p>Sample preparation: <input type="checkbox"/> pressed powder                      <input type="checkbox"/> fused glass disk</p>								

Tests performed by \_\_\_\_\_ Date \_\_\_\_\_  
 Tests reported by \_\_\_\_\_ Title \_\_\_\_\_  
 Phone \_\_\_\_\_ FAX \_\_\_\_\_ CCRL laboratory number \_\_\_\_\_

**CCRL PROFICIENCY SAMPLE PROGRAM  
PORTLAND CEMENT SAMPLES NO. 177 AND NO. 178  
PRIMARY CHEMICAL ANALYSIS REPORT FORM**

RETURN TO: R.K. Haupt, Supervisor, PSP  
Cement and Concrete Reference Laboratory  
National Institute of Standards and Technology  
100 Bureau Drive, Stop 8618  
Gaithersburg, Maryland 20899-8618  
FAX: 301-975-2243

FROM: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
e-mail: \_\_\_\_\_  
*Check here if name or address has changed* \_\_\_\_\_

	Sample No. 177	Sample No. 178	Test ID	X-ray *	ASTM Reference Wet Method	ASTM Reference Wet Method	A.A.	Other (specify)
Report values below to nearest 0.001%				Check the method used				
Sodium oxide, Na <sub>2</sub> O			90	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Phosphorus pentoxide, P <sub>2</sub> O <sub>5</sub>			102	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Zinc oxide, ZnO			99	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Manganic oxide, Mn <sub>2</sub> O <sub>3</sub>			101	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Chloride, Cl			104	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Chromium oxide, Cr <sub>2</sub> O <sub>3</sub>			105	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<p><b>*Please provide the following information the XRF equipment used for these results.</b></p> <p>XRF instrument:   <input type="checkbox"/> energy dispersive                      <input type="checkbox"/> wavelength dispersive</p> <p>Sample preparation:   <input type="checkbox"/> pressed powder                      <input type="checkbox"/> fused glass disk</p>								

Carbon dioxide, CO <sub>2</sub>			97	Report vale to nearest 0.01%				
<p>Method used to determine CO<sub>2</sub> (as described in Appendix X2 of C114) -</p> <p><input type="checkbox"/> Split loss on ignition    <input type="checkbox"/> Thermogravimetric analysis (TGA)    <input type="checkbox"/> ASTM Test method C 25, section 22</p> <p><input type="checkbox"/> XRF    <input type="checkbox"/> Combustion by induction furnance/IR    <input type="checkbox"/> ASTM Test method E 350    <input type="checkbox"/> Other</p>								
Limestone content in portland cement			98	Report values to nearest 0.1%				
CO <sub>2</sub> content in limestone	41%	39%		These values used in calculation of limestone content				

Potential Cement Phase Composition - Bogue calculations (as described in Annex A1 of ASTM C150)								
Tricalcium silicate, C <sub>3</sub> S			106	Report values to nearest 0.1%				
Dicalcium silicate, C <sub>2</sub> S			107					
Tricalcium aluminate, C <sub>3</sub> A			108					
Tetracalcium aluminoferrite, C <sub>4</sub> AF			109					

Tests performed by \_\_\_\_\_ Date \_\_\_\_\_  
 Tests reported by \_\_\_\_\_ Title \_\_\_\_\_  
 Phone \_\_\_\_\_ FAX \_\_\_\_\_ CCRL laboratory number \_\_\_\_\_

**CCRL PROFICIENCY SAMPLE PROGRAM  
 PORTLAND CEMENT SAMPLES NO. 177 AND NO. 178  
 PHYSICAL TESTS REPORT FORM**

RETURN TO: R.K. Haupt, Supervisor, PSP  
 Cement and Concrete Reference Laboratory  
 National Institute of Standards and Technology  
 100 Bureau Drive, Stop 8618  
 Gaithersburg, Maryland 20899-8618  
 FAX: 301-975-2243

FROM: \_\_\_\_\_  
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 e-mail: \_\_\_\_\_  
 Check here if name or address has changed \_\_\_\_\_

**TEST RESULTS**  
 Report as Indicated in ( )

	<u>Sample No.</u> <b>177</b>	<u>Sample No.</u> <b>178</b>	
<b>NORMAL CONSISTENCY:</b>			
Water (nearest 0.1 percent by weight of cement) .....	_____	_____	[110]
<b>VICAT TIME OF SETTING:</b>			
Initial Set, Report in <b>minutes</b> (nearest 5 minutes) .....	_____	_____	[120]
Final Set, Report in <b>minutes</b> (nearest 5 minutes) .....	_____	_____	[121]
<b>Is automated Vicat Instrument used?</b> <input type="checkbox"/> yes <input type="checkbox"/> no			
Manufacturer of automated Vicat: _____			
<b>GILLMORE TIME OF SETTING:</b>			
Initial Set, Report in <b>minutes</b> (nearest 5 minutes) .....	_____	_____	[130]
Final Set, Report in <b>minutes</b> (nearest 5 minutes) .....	_____	_____	[140]
<b>FALSE SET (PASTE METHOD):</b>			
Final Penetration / Initial Penetration (nearest percent) .....	_____	_____	[150]
<b>AUTOCLAVE EXPANSION:</b>	<u>No. 177</u>	<u>No. 178</u>	
Final Reading	_____	_____	
Initial Reading	_____	_____	
Difference	_____	_____	
Percent Expansion (nearest 0.01 percent) .....	_____	_____	[160]
<b>AIR ENTRAINMENT:</b>			
Percent Air (nearest 0.1 percent) .....	_____	_____	[170]
Mixing water (nearest 0.1 percent by weight of cement) .....	_____	_____	[180]
Flow Obtained (nearest percent) .....	_____	_____	[190]

Tests performed by \_\_\_\_\_ Date \_\_\_\_\_  
 Tests reported by \_\_\_\_\_ Title \_\_\_\_\_  
 Phone \_\_\_\_\_ Fax \_\_\_\_\_ CCRL Laboratory Number \_\_\_\_\_

**CCRL PROFICIENCY SAMPLE PROGRAM  
 PORTLAND CEMENT SAMPLES NO. 177 AND NO. 178  
 PHYSICAL TESTS REPORT FORM**

RETURN TO: R.K. Haupt, Supervisor, PSP  
 Cement and Concrete Reference Laboratory  
 National Institute of Standards and Technology  
 100 Bureau Drive, Stop 8618  
 Gaithersburg, Maryland 20899-8618  
 FAX: 301-975-2243

FROM: \_\_\_\_\_  
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 e-mail: \_\_\_\_\_  
*Check here if name or address has changed* \_\_\_\_\_

**TEST RESULTS**  
*Report as Indicated in ( )*

	<u>Sample No.</u> <u>177</u>	<u>Sample No.</u> <u>178</u>	
<b>COMPRESSIVE STRENGTH:</b>	<u>No. 177</u>	<u>No.178</u>	
3-day, total load, lbs.	1) _____	_____	
	2) _____	_____	
	3) _____	_____	
Average 3-day strength ( <i>nearest 10 psi</i> ) .....	_____	_____	[200]
7-day, total load, lbs.	1) _____	_____	
	2) _____	_____	
	3) _____	_____	
Average 7-day strength ( <i>nearest 10 psi</i> ) .....	_____	_____	[210]
28-day, total load, lbs.	1) _____	_____	
	2) _____	_____	
	3) _____	_____	
Average 28-day strength ( <i>nearest 10 psi</i> ) .....	_____	_____	[211]
Flow Obtained for compressive strength mortar - constant water ( <i>nearest percent</i> ) ..	_____	_____	[230]

**Information on cube molds and sealants (used for informational purposes only):**

Type of cube mold:  cube mold NOT clamped to base plate     cube mold clamped to base plate  
 Type of sealant used between cube mold and base plate:  
 wax     grease     other - please specify \_\_\_\_\_

**FINENESS:**

Air Permeability, ( <i>nearest 10 cm<sup>2</sup>/g</i> ) .....	_____	_____	[270]
Wagner Turbidimeter, ( <i>nearest 10 cm<sup>2</sup>/g</i> ) .....	_____	_____	[280]
45 µm (No. 325) Sieve, Corrected percent <u>passing</u> ( <i>nearest 0.01 percent</i> ) .....	_____	_____	[281]
	<u>No. 177</u>	<u>No. 178</u>	
Correction Factor for 45 µm sieve ( <i>nearest 0.1 percent</i> )	_____	_____	

**Comments:**

Tests performed by \_\_\_\_\_ Date \_\_\_\_\_  
 Tests reported by \_\_\_\_\_ Title \_\_\_\_\_  
 Phone \_\_\_\_\_ Fax \_\_\_\_\_ CCRL Laboratory Number \_\_\_\_\_

**CCRL PROFICIENCY SAMPLE PROGRAM  
 PORTLAND CEMENT SAMPLES NO. 177 AND NO. 178  
 C1038 REPORT FORM**

RETURN TO: R.K. Haupt, Supervisor, PSP  
 Cement and Concrete Reference Laboratory  
 National Institute of Standards and Technology  
 100 Bureau Drive, Stop 8618  
 Gaithersburg, Maryland 20899-8618  
 FAX: 301-975-2243

FROM: \_\_\_\_\_  
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 e-mail: \_\_\_\_\_  
 Check here if name or address has changed \_\_\_\_\_

**C1038 EXPANSION OF PORTLAND CEMENT MORTAR BARS STORED IN WATER**

	Sample No. 177				Sample No. 178			
	Bar				Bar			
	#1	#2	#3	#4	#1	#2	#3	#4
Final reading								
Initial reading								
Difference (final - initial)								
Expansion ( <i>nearest 0.001%</i> )								
<b>Average expansion</b> [400] ( <i>nearest 0.001%</i> )								
<b>C1038 Mortar - Mix water</b> [401] ( <i>nearest millilitre</i> )								
<b>C1038 Mortar - Flow</b> [402] ( <i>nearest percent</i> )								

Tests performed by \_\_\_\_\_ Date \_\_\_\_\_  
 Tests reported by \_\_\_\_\_ Title \_\_\_\_\_  
 Phone \_\_\_\_\_ Fax \_\_\_\_\_ CCRL Laboratory Number \_\_\_\_\_

**CCRL PROFICIENCY SAMPLE PROGRAM  
PORTLAND CEMENT SAMPLES NO. 177 AND NO. 178  
HEAT OF HYDRATION REPORT FORM**

RETURN TO: R.K. Haupt, Supervisor, PSP  
Cement and Concrete Reference Laboratory  
National Institute of Standards and Technology  
100 Bureau Drive, Stop 8618  
Gaithersburg, Maryland 20899-8618  
FAX: 301-975-2243

FROM: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
e-mail: \_\_\_\_\_  
*Check here if name or address has changed* \_\_\_\_\_

**C186 HEAT OF HYDRATION OF HYDRAULIC CEMENT**

	<b>Sample No.</b> <u>177</u>	<b>Sample No.</b> <u>178</u>	
<b>HEAT OF SOLUTION:</b>			
Dry Cement, cal/g ( <i>nearest 0.1 cal/g</i> ) .....	_____	_____	[291]
Partially hydrated, 7-day cal/g ( <i>nearest 0.1 cal/g</i> ) .....	_____	_____	[292]
Partially hydrated, 28-day cal/g ( <i>nearest 0.1 cal/g</i> ) .....	_____	_____	[301]
<b>HEAT OF HYDRATION:</b>			
7-day, cal/g ( <i>nearest 0.1 cal/g</i> ) .....	_____	_____	[290]
28-day, cal/g ( <i>nearest 0.1 cal/g</i> ) .....	_____	_____	[300]

**C1702 HEAT OF HYDRATION BY ISOTHERMAL CONDUCTION CALORIMETRY**

	<b>Sample No.</b> <u>177</u>	<b>Sample No.</b> <u>178</u>	
3-day, J/g ( <i>nearest 1 J/g</i> ) .....	_____	_____	[500]
7-day, J/g ( <i>nearest 1 J/g</i> ) .....	_____	_____	[510]

**Method Used:**

- Method A - sample and water are both temperature equilibrated and mixed inside the calorimeter.
- Method B - sample is mixed outside of the calorimeter then put into the calorimeter.

**Instrument Used:**

Manufacturer: \_\_\_\_\_  
Model: \_\_\_\_\_

Tests performed by \_\_\_\_\_ Date \_\_\_\_\_  
Tests reported by \_\_\_\_\_ Title \_\_\_\_\_  
Phone \_\_\_\_\_ Fax \_\_\_\_\_ CCRL Laboratory Number \_\_\_\_\_

**CCRL PROFICIENCY SAMPLE PROGRAM  
PORTLAND CEMENT SAMPLES NO. 177 AND NO. 178  
SECONDARY CHEMICAL ANALYSIS REPORT FORM**

RETURN TO: R.K. Haupt, Supervisor, PSP  
Cement and Concrete Reference Laboratory  
National Institute of Standards and Technology  
100 Bureau Drive, Stop 8618  
Gaithersburg, Maryland 20899-8618  
FAX: 301-975-2243

FROM: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
e-mail: \_\_\_\_\_  
*Check here if name or address has changed* \_\_\_\_\_

## SECONDARY CHEMICAL ANALYSIS

Note: A final report on these results will not be provided to your laboratory unless you subscribe to the Secondary Chemical Analysis program. More information about this program and how to enroll in the program is available on the page titled "Information on CCRL Portland Chemical Analysis Program".

	Sample No. 177	Sample No. 178	Test ID	X-ray *	ASTM Alternate Wet Method	ASTM Reference Wet Method	A.A.	Other (specify)
Report values below to nearest 0.01%				Check the method used				
Silicon dioxide, SiO <sub>2</sub>			10	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Aluminum oxide, Al <sub>2</sub> O <sub>3</sub>			21	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Ferric oxide, Fe <sub>2</sub> O <sub>3</sub>			30	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Calcium oxide, CaO			40	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Free Calcium oxide			41	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Magnesium oxide, MgO			50	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Sulfur trioxide, SO <sub>3</sub>			60	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Loss on ignition			70	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Briefly describe LOI procedure:								
Insoluble residue			80	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Potassium oxide, K <sub>2</sub> O			100	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Titanium dioxide, TiO <sub>2</sub>			103	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<p><b>*Please provide the following information the XRF equipment used for these results.</b></p> <p>XRF instrument:   <input type="checkbox"/> energy dispersive                      <input type="checkbox"/> wavelength dispersive</p> <p>Sample preparation: <input type="checkbox"/> pressed powder                      <input type="checkbox"/> fused glass disk</p>								

Tests performed by \_\_\_\_\_ Date \_\_\_\_\_  
 Tests reported by \_\_\_\_\_ Title \_\_\_\_\_  
 Phone \_\_\_\_\_ FAX \_\_\_\_\_ CCRL laboratory number \_\_\_\_\_

**CCRL PROFICIENCY SAMPLE PROGRAM  
PORTLAND CEMENT SAMPLES NO. 177 AND NO. 178  
SECONDARY CHEMICAL ANALYSIS REPORT FORM**

RETURN TO: R.K. Haupt, Supervisor, PSP  
Cement and Concrete Reference Laboratory  
National Institute of Standards and Technology  
100 Bureau Drive, Stop 8618  
Gaithersburg, Maryland 20899-8618  
FAX: 301-975-2243

FROM: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
e-mail: \_\_\_\_\_  
*Check here if name or address has changed* \_\_\_\_\_

	Sample No. 177	Sample No. 178	Test ID	X-ray *	ASTM Reference Wet Method	ASTM Reference Wet Method	A.A.	Other (specify)
Report values below to nearest 0.001%				Check the method used				
Sodium oxide, Na <sub>2</sub> O			90	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Phosphorus pentoxide, P <sub>2</sub> O <sub>5</sub>			102	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Zinc oxide, ZnO			99	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Manganic oxide, Mn <sub>2</sub> O <sub>3</sub>			101	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Chloride, Cl			104	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Chromium oxide, Cr <sub>2</sub> O <sub>3</sub>			105	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<p><b>*Please provide the following information the XRF equipment used for these results.</b></p> <p>XRF instrument:   <input type="checkbox"/> energy dispersive                      <input type="checkbox"/> wavelength dispersive</p> <p>Sample preparation: <input type="checkbox"/> pressed powder                      <input type="checkbox"/> fused glass disk</p>								

Carbon dioxide, CO <sub>2</sub>			97	Report vale to nearest 0.01%				
<p>Method used to determine CO<sub>2</sub> (as described in Appendix X2 of C114) -</p> <p><input type="checkbox"/> Split loss on ignition   <input type="checkbox"/> Thermogravimetric analysis (TGA)   <input type="checkbox"/> ASTM Test method C 25, section 22</p> <p><input type="checkbox"/> XRF   <input type="checkbox"/> Combustion by induction furnance/IR   <input type="checkbox"/> ASTM Test method E 350   <input type="checkbox"/> Other</p>								
Limestone content in portland cement			98	Report values to nearest 0.1%				
CO <sub>2</sub> content in limestone	41%	39%		These values used in calculation of limestone content				

Potential Cement Phase Composition - Bogue calculations (as described in Annex A1 of ASTM C150)								
Tricalcium silicate, C <sub>3</sub> S			106	Report values to nearest 0.1%				
Dicalcium silicate, C <sub>2</sub> S			107					
Tricalcium aluminate, C <sub>3</sub> A			108					
Tetracalcium aluminoferrite, C <sub>4</sub> AF			109					

Tests performed by \_\_\_\_\_ Date \_\_\_\_\_  
 Tests reported by \_\_\_\_\_ Title \_\_\_\_\_  
 Phone \_\_\_\_\_ FAX \_\_\_\_\_ CCRL laboratory number \_\_\_\_\_