U. S. Department of Commerce
Maurice H. Stans
Secretary

National Bureau of Standards
L. M. Branscomb, Director

Certificate of Analysis

Standard Reference Material 1095

AISI 4340 Steel

(Gasometric Standard)

This standard is in the form of rods 6.4 mm (1/4 in) in diameter and 102 mm (4 in) long for the determination of gases in metals by vacuum or inert gas fusion and neutron activation methods of analyses.[a]

Element	PPM by Weight
Oxygen	9[b]
Nitrogen	(37)[c]
Hydrogen	(<5)

[a]This material also is available in the form of disks, SRM 1261, 31 mm (1 1/4 in) in diameter and 19 mm (3/4 in) thick for use in optical emission and x-ray spectrometric analysis; chips, SRM 361, for use in chemical methods of analysis; and rods, SRM 661, 3.2 mm (1/8 in) in diameter and 51 mm (2 in) long for application in microchemical methods of analysis such as electron probe microanalysis, spark source mass spectrometric analysis, and laser probe analysis.

[b]The certified value of 9 ppm oxygen is based on the following pertinent analytical data:

NBS			Applied Research Laboratory; U. S. Steel Corp.					
Vacuum Fusion			Vacuum Fusion			Neutron Activation		
$\bar{X}$	s	n	$\bar{X}$	s	n	$\bar{X}$	s	n
8.3	1.2	44	10.0	1.4	12	8.8	1.3	4*

$\bar{X}$ = mean oxygen value; s = standard deviation of a single determination; n = number of independent determinations

*The average of 10 replicate measurements was reported for each of 4 samples.

[c]Values in parenthesis are not certified since they are based on the results from a single laboratory.

The overall direction and coordination of the technical measurements at NBS leading to certification were performed under the direction of O. Menis and J. T. Sterling.

The technical and support aspects involved in the preparation, certification, and issuance of this standard reference material were coordinated through the Office of Standard Reference Materials by R. E. Michaelis.

Washington, D. C. 20234
October 23, 1970

J. Paul Cali, Acting Chief
Office of Standard Reference Materials

(over)

PLANNING, PREPARATION, TESTING, ANALYSIS: This standard is one of five replacements for the original eight 1100 series iron and steel SRMs. Material from the same melt is available in a variety of forms to serve in checking methods of analysis and in calibrating instrumental techniques.

The material for this standard was vacuum melted and cast at the Carpenter Technology Corporation, Reading, Pennsylvania, under a contract with the National Bureau of Standards. The contract was made possible by a grant from the American Iron and Steel Institute.

The ingots were processed by Carpenter Technology Corporation to provide material of the highest possible homogeneity. Following acceptance of the composition based on NBS analyses, selected portions of the ingot material were extensively tested for homogeneity at NBS by D. M. Bouchette, S. D. Rasberry, and J. L. Weber, Jr. Only that material meeting a critical evaluation was processed to the final shapes and sizes.

Cooperative analyses for oxygen were performed in the Applied Research Laboratory, United States Steel Corporation, Monroeville, Pennsylvania, by J. F. Martin and E. E. Wicker.

Analyses for oxygen were performed in the Analytical Chemistry Division of the National Bureau of Standards by J. T. Sterling.

CAUTION: Oxygen determinations should be made on thoroughly and freshly cleaned samples.

PREPARATION FOR THE DETERMINATION OF OXYGEN:

1. Samples should be cut from the original rod to minimize heating of the sample; i.e., by a hand hacksaw.
2. All surfaces of the cut sample should be thoroughly cleaned with a fine file.
3. Samples should be washed with C. P. ether, acetone, or other suitable solvent, dried in a stream of warm clean air and then handled only with clean forceps.
4. Analyses should be made as soon as possible after cleaning the sample.

. S. Department of Commerce
Malcolm Baldrige
Secretary

National Bureau of Standards
Ernest Ambler, Director

National Bureau of Standards
Certificate of Analysis
Standard Reference Material 1096
AISI 94B17 Steel (Modified)
(Gasometric Standard)

This Standard Reference Material (SRM) is in the form of a rod 6.4 mm (1/4 in) in diameter and 102 mm (4 in) long. SRM 1096 is intended for use in the determination of gases in metals by vacuum or inert gas fusion and neutron activation methods of analyses.

Element	PPM by Weight[a]
Oxygen	10.7
Nitrogen	40.4
Hydrogen	(<5)[b]

[a]The values given in this certificate are based on the analytical data given below.
[b]Value in parentheses is not certified.

Oxygen

Laboratory	Average, (PPM by wt)	Standard Deviation[1]	Number of Determinations
Bethlehem Steel	12.2	1.4	20
U.S. Steel	10.5	0.9	28
Armco Steel	9.4	1.2	28
Average[2]	10.7	---	---
NBS[3]	10.5		

Nitrogen

Bethlehem Steel	39.5	0.5	10
U.S. Steel	42.0		
Armco Steel	39.7	1.9	29
Average[2]	40.4	---	---
NBS[3]	40.0		
Inland Steel[3]	40.6		

[1]Of single determination
[2]Unweighted arithmetic average
[3]For information only

The technical and support aspects involved in the preparation, certification, and issuance of this Standard Reference Material were coordinated through the Office of Standard Reference Materials by R.E. Michaelis.

Gaithersburg, MD 20899
April 21, 1986
(Revision of Certificate
dated 6-13-72)

Stanley D. Rasberry, Chief
Office of Standard Reference Materials

(over)

PLANNING, PREPARATION, TESTING, AND ANALYSIS:

The material for this standard was vacuum melted and cast at the Carpenter Technology Corporation, Reading, Pennsylvania, under a contract with the National Bureau of Standards. The contract was made possible by a grant from the American Iron and Steel Institute.

The ingots were processed by Carpenter Technology Corporation to provide material of the highest possible homogeneity. Following acceptance of the composition based on NBS analyses, selected portions of the ingot material were extensively tested for homogeneity at NBS by D.M. Bouchette, S.D. Rasberry, and J.L. Weber, Jr. Only that material meeting a critical evaluation was processed to the final shapes and sizes.

Cooperative analyses for oxygen and nitrogen were performed in the Applied Research Laboratory, United States Steel Corporation, Monroeville, Pennsylvania, by J.F. Martin; Homer Research Laboratories, Bethlehem Steel Corporation, Bethlehem, Pennsylvania, by F.H. Ruch; and Research and Technology, Armco Steel Corporation, Middletown, Ohio, by L.C. Ikenberry.

Analyses for oxygen and nitrogen on samples from the melt were performed in the Analytical Chemistry Division of the National Bureau of Standards by J.T. Sterling; and for nitrogen only in the Analytical Laboratory of Inland Steel Company, East Orange, Indiana, by J.E. Joyce.

CAUTION: Oxygen determinations should be made on thoroughly and freshly cleaned samples.

PREPARATION FOR THE DETERMINATION OF OXYGEN:

1. Samples should be cut from the original rod to minimize heating of the sample; e.g., by a hand hacksaw.
2. All surfaces of the cut samples should be thoroughly cleaned with a fine file.
3. Samples should be washed with C.P. ether, acetone, or other suitable solvent, dried in a stream of warm clean air and then handled only with clean forceps.
4. Analyses should be made as soon as possible after cleaning the sample.

. Department of Commerce
Malcolm Baldrige
Secretary
ational Bureau of Standards
Ernest Ambler, Director

National Bureau of Standards

Certificate of Analysis

Standard Reference Material 1097

Cr–V Steel (Modified)

(Gasometric Standard)

This Standard Reference Material (SRM) is in the form of a rod 6.4 mm (1/4 in) in diameter and 102 mm (4 in) long. SRM 1097 is intended for use in the determination of gases in metals by vacuum or inert gas fusion and neutron activation methods of analyses.

Element	PPM by Weight
Oxygen	6.6[a]
Nitrogen	(41)[b]
Hydrogen	(<5)

[a]The certified value for oxygen is based on the analytical data given below.
[b]Values in parentheses are not certified.

Oxygen

Laboratory	Average, (PPM by wt)	Standard Deviation[1]	Number of Determinations
Battelle	6.48	0.82	25
U.S. Steel	6.67	1.03	31
Average[2]	6.6		
NBS[3]	6.0		
J & L[3]	10.7		

[1]Of single determination
[2]Arithmetic average of two averages above
[3]For information only

The technical and support aspects involved in the preparation, certification, and issuance of this Standard Reference Material were coordinated through the Office of Standard Reference Materials by R.E. Michaelis.

Gaithersburg, MD 20899
April 21, 1986
(Revision of Certificate
dated 5-26-72)

Stanley D. Rasberry, Chief
Office of Standard Reference Materials

(over)

PLANNING, PREPARATION, TESTING, AND ANALYSIS:

The material for this standard was vacuum melted and cast at the Carpenter Technology Corporation, Reading, Pennsylvania, under a contract with the National Bureau of Standards. The contract was made possible by a grant from the American Iron and Steel Institute.

The ingots were processed by Carpenter Technology Corporation to provide material of the highest possible homogeneity. Following acceptance of the composition based on NBS analyses, selected portions of the ingot material were extensively tested for homogeneity at NBS by D.M. Bouchette, S.D. Rasberry, and J.L. Weber, Jr. Only that material meeting a critical evaluation was processed to the final shapes and sizes.

Cooperative analyses for oxygen were performed in the Applied Research Laboratory, United States Steel Corporation, Monroeville, Pennsylvania, by J.F. Martin; and for oxygen and nitrogen in the Columbus Laboratories, Battelle Memorial Institute, Columbus, Ohio, by M.A. Van Camp; and in the Graham Research Laboratory, Jones & Laughlin Steel Corporation, Pittsburgh, Pennsylvania, by C.R. Hines.

Analyses for oxygen and nitrogen on samples from the melt were performed in the Analytical Chemistry Division of the National Bureau of Standards by J.T. Sterling.

CAUTION: Oxygen determinations should be made on thoroughly and freshly cleaned samples.

PREPARATION FOR THE DETERMINATION OF OXYGEN:

1. Samples should be cut from the original rod to minimize heating of the sample; e.g., by a hand hacksaw.
2. All surfaces of the cut samples should be thoroughly cleaned with a fine file.
3. Samples should be washed with C.P. ether, acetone, or other suitable solvent, dried in a stream of warm clean air and then handled only with clean forceps.
4. Analyses should be made as soon as possible after cleaning the sample.

S. Department of Commerce
Malcolm Baldrige
Secretary

National Bureau of Standards
Ernest Ambler, Director

National Bureau of Standards

Certificate of Analysis

Standard Reference Material 1098

High-Carbon Steel (Modified)

(Gasometric Standard)

This Standard Reference Material (SRM) is in the form of a rod 6.4 mm (1/4 in) in diameter and 102 mm (4 in) long. SRM 1098 is intended for use in the determination of gases in metals by vacuum or inert gas fusion and neutron activation methods of analyses.

Element[a]	Midrange Value[b] (ppm by wt.)
Oxygen	10
Nitrogen	32

[a]Hydrogen is not included (<5 ppm)
[b]Average of midrange values from two cooperating laboratories.

Laboratory	Range of Results[1]	Midrange Value
	Oxygen	
NRL	9.2 to 12.0	10.6
Battelle	6.8 to 11.3	9.0
	Nitrogen	
NRL	31.1 to 36.7	33.9
Battelle	27.5 to 33.5	30.5

[1]Average of duplicate vacuum fusion determinations made on samples cut from 12 individual rods.

The technical and support aspects involved in the preparation, certification, and issuance of this Standard Reference Material were coordinated through the Office of Standard Reference Materials by R.E. Michaelis.

Gaithersburg, MD 20899
April 21, 1986
(Revision of Certificate
dated 10-3-73)

Stanley D. Rasberry, Chief
Office of Standard Reference Materials

(over)

PLANNING, PREPARATION, TESTING, AND ANALYSIS:

The material for this standard was vacuum melted and cast at the Carpenter Technology Corporation, Reading, Pennsylvania, under a contract with the National Bureau of Standards. The contract was made possible by a grant from the American Iron and Steel Institute.

The ingots were processed by Carpenter Technology Corporation to provide material of the highest possible homogeneity. Following acceptance of the composition based on NBS analyses, selected portions of the ingot material were extensively tested for homogeneity at NBS by D.M. Bouchette, S.D. Rasberry, and J.L. Weber, Jr. Only that material meeting a critical evaluation was processed to the final shapes and sizes.

Cooperative analysis for oxygen and nitrogen were performed in the Columbus Laboratories, Battelle Memorial Institute, Columbus, Ohio by R.E. Heffelfinger; and in the Analytical Chemistry Branch, Naval Research Laboratory, Washington, D.C., by W.A. Fraser.

CAUTION: Oxygen determinations should be made on thoroughly and freshly cleaned samples.

PREPARATION FOR THE DETERMINATION OF OXYGEN:

1. Samples should be cut from the original rod to minimize heating of the sample; e.g., by a hand hacksaw.
2. All surfaces of the cut samples should be thoroughly cleaned with a fine file.
3. Samples should be washed with C.P. ether, acetone, or other suitable solvent, dried in a stream of warm clean air and then handled only with clean forceps.
4. Analyses should be made as soon as possible after cleaning the sample.

U. S. Department of Commerce
Malcolm Baldrige
Secretary

National Bureau of Standards
Ernest Ambler, Director

National Bureau of Standards

Certificate of Analysis

Standard Reference Material 1099

Electrolytic Iron

(Gasometric Standard)

This Standard Reference Material (SRM) is in the form of a rod 6.4 mm (1/4 in) in diameter and 102 mm (4 in) long. SRM 1099 is intended for use in the determination of gases in metals by vacuum or inert gas fusion and neutron activation methods of analyses. The oxygen content of this standard was determined by vacuum fusion at NBS.

Element	PPM by Weight
Oxygen	61 ± 3[a]
Nitrogen	(13)[b]
Hydrogen	(<5)

[a]The standard deviation of a single determination based on 126 measurements on selected rod material.

[b]Values in parentheses are not certified.

The overall direction and coordination of the technical measurements at NBS leading to certification were performed under the direction of O. Menis and J.T. Sterling.

The technical and support aspects involved in the preparation, certification, and issuance of this Standard Reference Material were coordinated through the Office of Standard Reference Materials by R.E. Michaelis.

Gaithersburg, MD 20899
April 21, 1986
(Revision of Certificate
dated 7-28-70)

Stanley D. Rasberry, Chief
Office of Standard Reference Materials

(over)

PLANNING, PREPARATION, TESTING, AND ANALYSIS:

The material for this standard was vacuum melted and cast at the Carpenter Technology Corporation, Reading, Pennsylvania, under a contract with the National Bureau of Standards. The contract was made possible by a grant from the American Iron and Steel Institute.

The ingots were processed by Carpenter Technology Corporation to provide material of the highest possible homogeneity. Following acceptance of the composition based on NBS analyses, selected portions of the ingot material were extensively tested for homogeneity at NBS by D.M. Bouchette, S.D. Rasberry, and J.L. Weber, Jr. Only that material meeting a critical evaluation was processed to the final shapes and sizes.

Analyses for oxygen were performed in the Analytical Chemistry Division of the National Bureau of Standards by J.T. Sterling.

CAUTION: Oxygen determinations should be made on thoroughly and freshly cleaned samples.

PREPARATION FOR THE DETERMINATION OF OXYGEN:

1. Samples should be cut from the original rod to minimize heating of the sample; e.g., by a hand hacksaw.
2. All surfaces of the cut samples should be thoroughly cleaned with a fine file.
3. Samples should be washed with C.P. ether, acetone, or other suitable solvent, dried in a stream of warm clean air and then handled only with clean forceps.
4. Analyses should be made as soon as possible after cleaning the sample.

CONDITIONS FOR ANALYSIS AT NBS:

Method	Vacuum fusion
Furnace temperature	1675 °C
Furnace pressure	$<10^{-5}$ torr
Collection time	4 min
Bath material	High-purity nickel
Carbon monoxide determination	Infrared absorption