

METALS SPECIFIC TEST INSTRUCTIONS

Table of Contents

1. General Instructions

2. Dimensional

Analysis #101 Dimensional: Outside Diameter of Plain Plug Gage

3. Tensile Tests

Analysis #105-107 Tensile Properties of Lab-Machined Flat Aluminum

Analysis #110-113 Tensile Properties of Pre-Machined Round Steel

Analysis #130-132 Tensile Properties of Lab-Machined Flat Steel

Analysis #140-143 Tensile Properties of Lab-Machined Round Steel

4. Fasteners Tests

Analysis #115 Fastener Wedge Tensile (10°)

Analysis #116 Fastener Axial Tensile

Analysis #125 Rockwell (C Scale) Hardness of Externally Threaded Fasteners

Analysis #126 Vickers Hardness of Externally Threaded Fasteners

Analysis #127 Fastener Wedge Tensile (10°) Metric

Analysis #128 Fastener Axial Tensile - Metric

Analysis #129 Fastener Double Shear

5. Metallography

Analysis #145-146 Case Depth

Analysis # 121-123 Microhardness (Knoop & Vickers)

6. Hardness Tests

Analysis #118&120 Rockwell (C Scale)

Analysis #118&119 Rockwell (B Scale)

Analysis #135 Brinell Hardness

Analysis #136 Rockwell Superficial Hardness (30N Scale)

7. Chemical Analysis

Analysis #150-157 Nickel-Based Alloy

Analysis #160-167 Copper-Based Alloy

Analysis #170-179 Carbon & Low Alloy Steel

Analysis #180-189 Corrosion Resistant Steel

METALS SPECIFIC TEST INSTRUCTIONS

Please review the following information before testing.

1. The Sample Pack Code has been added to the data sheets to assist labs in matching the data sheets with the samples.
2. Participants in the Tensile Properties and the Chemical Analysis tests will notice that the results for each property or element are now reported on a separate data sheet.
3. Please return **all** data sheets to CTS for processing. If you are not reporting data for a property or element, RETURN THE BLANK DATA SHEET TO CTS.
4. If you are faxing the data sheets to CTS, you **MUST** use a cover sheet indicating the total number of pages you are sending.
6. We suggest all test materials to be checked upon receipt. If any materials are missing, damaged or are not in the good shape, please notify CTS and we will replace the samples. All requests for replacements must be received no later than two weeks before the data due date.

METALS SPECIFIC TEST INSTRUCTIONS

DIMENSIONAL: OUTSIDE DIAMETER OF PLAIN PLUG GAGE

Analysis: 101

Pack: PI

Properties Measured: Diameter of the samples.

Sample Information: The two samples are 2" long individual gage pins. The samples are made from Carbon Chrome alloy steel and heat treated to 60-62 Rockwell C hardness. Laboratories are cautioned that the specimens are NOT etched with the sample codes found on the data sheets. However, the carrier packaging tubes are labeled with samples codes. The laboratory will need to mark the specimens with the sample codes (Do not make any marks on measured surfaces).

Sample Preparation: The samples are ready to test; no sample preparation required.

Test Procedure: Follow your normal testing procedure. Make five determinations per sample, taking each measurement from a different section of the sample, but not closer than 1/16" to the edges. Use one instrument and one operator for all measurements. Measure both samples on the same day.

HOW TO REPORT DATA: For the purposes of this interlaboratory testing program, please report test results to the following precision:

Micrometers - To nearest 0.0001 in or 0.001 mm,

Calipers - To nearest 0.001 in or 0.01 mm

If you are using the other type of instrument or you are unable to report to the precision above, please contact CTS for further instructions.

METALS SPECIFIC TEST INSTRUCTIONS

TENSILE PROPERTIES: LAB-MACHINED FLAT ALUMINUM SPECIMENS

Analysis: 105 - 107

Pack: PR

Test Method: ASTM B557 If you use a different test method that is comparable to B557, note this on the data sheets.

Properties Measured: Tensile Strength, Yield Strength, and Elongation. CTS does not require participants to report for all three properties.

Sample Information: The two samples are 3" x 14" blanks. The specimens are NOT etched with the sample codes found on the data sheets. Alphanumeric codes used by CTS are present on the specimens, but do not correspond to the sample codes. The laboratory must mark the specimens with the sample codes.

Sample Preparation: Machine one tensile specimen from the center of each blank. The preferred specimen has a 2 inch gage length and 0.5 inch wide reduced section. Do not use sub-size specimens. See ASTM B557 for specimen diagrams.

Test Method: After preparing the samples, test them according to ASTM B557. Use one instrument and one operator for all measurements. Measure both samples on the same day.

HOW TO REPORT DATA: For the purposes of this interlaboratory testing program, please report test results to the following precision:

Tensile Strength and Yield Strength - To nearest 0.1 ksi or 100 psi or 0.1 MPa

Elongation - Report the percentage increase to the nearest 0.1%.
If equipment can only measure to nearest 0.5%, report the data and indicate this fact on the data sheet.

Verify that pre-printed units on the data sheets are correct. If not, select and indicate one of the valid units listed on the datasheet (*ksi is the default unit for tensile strength and yield strength values*).

METALS SPECIFIC TEST INSTRUCTIONS

TENSILE PROPERTIES: PRE-MACHINED ROUND STEEL SPECIMENS

Analysis: 110 - 113

Pack: PA

Test Method: ASTM E8. If you use a different test method that is comparable to E8, note this on the data sheets.

Properties Measured: Tensile Strength, Yield Strength, Elongation, and Reduction of Area. CTS does not require participants to report for all four properties.

Sample Information: The two samples are machined, R1 tensile specimens (5 inches long, 0.505 inch diameter, 3/4-10 UNC-2). The specimens are NOT etched with the sample codes found on the data sheets. Alphanumeric codes used by CTS are present on the specimens, but do not correspond to the sample codes. The laboratory must mark the specimens with the sample codes.

Special Requirements: *Determine the Yield Strength that is specified on your dataset.* Follow the instructions in ASTM E8. The samples may exhibit continuous or discontinuous yielding. Determine the Yield Strength using the 0.2% Offset Method in case of continuous yielding. Determine the Upper Yield Strength (UYS) for both samples *if it is available*. Use the Autographic Diagram Method or the Halt-of-Force Method (Drop-of-the-Beam). Please refer to ASTM E8 for definition of these terms.

HOW TO REPORT DATA: For the purposes of this interlaboratory testing program, please report test results to the following precision:

Tensile Strength and Yield Strength - To nearest 0.1 ksi or 100 psi or 0.1 MPa

Elongation and Reduction of Area - Report the percentage increase to the nearest 0.1%.
If equipment can only measure to nearest 0.5%, report the data and indicate this fact on the data sheet.

Verify that pre-printed units on the data sheets are correct. If not, select and indicate one of the valid units listed on the datasheet (*ksi is the default unit for tensile strength and yield strength values*).

METALS SPECIFIC TEST INSTRUCTIONS

TENSILE PROPERTIES: LAB-MACHINED FLAT STEEL SPECIMENS

Analysis: 130 - 132

Pack: PF

Test Method: ASTM E8. If you use a different test method that is comparable to E8, note this on the data sheets.

Properties Measured: Tensile Strength, Yield Strength, and Elongation. CTS does not require participants to report for all three properties.

Sample Information: The two samples are 3" x 14" blanks. The specimens are NOT etched with the sample codes found on the data sheets. Alphanumeric codes used by CTS are present on the specimens, but do not correspond to the sample codes. The laboratory must mark the specimens with the sample codes.

Sample Preparation: Machine one tensile specimen from the center of each blank. The preferred specimen has a 2 inch gage length and 0.5 inch wide reduced section. Do not use sub-size specimens. See ASTM E8 for specimen diagrams.

Test Method: After preparing the samples, test them according to ASTM E8. Determine the Yield Strength using the 0.2% Offset Method. Use one instrument and one operator for all measurements. Measure both samples on the same day.

HOW TO REPORT DATA: For the purposes of this interlaboratory testing program, please report test results to the following precision:

Tensile Strength and Yield Strength - To nearest 0.1 ksi or 100 psi or 0.1 MPa

Elongation - Report the percentage increase to the nearest 0.1%.
If equipment can only measure to nearest 0.5%, report the data and indicate this fact on the data sheet.

Verify that pre-printed units on the data sheets are correct. If not, select and indicate one of the valid units listed on the datasheet (**ksi** is the default unit for tensile strength and yield strength values).

METALS SPECIFIC TEST INSTRUCTIONS

TENSILE PROPERTIES: LAB-MACHINED ROUND STEEL SPECIMENS

Analysis: 140 - 143

Pack: PP

Test Method: ASTM E8. If you use a different test method that is comparable to E8, note this on the data sheets.

Properties Measured: Tensile Strength, Yield Strength, Elongation, and Reduction of Area. CTS does not require participants to report for all four properties.

Sample Information: The specimens are NOT etched with the sample codes found on the data sheets. Alphanumeric codes used by CTS are present on the specimens, but do not correspond to the sample codes. The laboratory must mark the specimens with the sample codes.

Sample Preparation: It is first necessary to machine a tension specimen from each of the two bars. Refer to ASTM E8 for diagrams of appropriate specimens. The preferred specimen is 0.5 inches in diameter with a 2 inch gage length.

Special Requirements: *Determine the Yield Strength that is specified on your dataset.* Follow the instructions in ASTM E8. The samples may exhibit continuous or discontinuous yielding. Determine the Yield Strength using the 0.2% Offset Method in case of continuous yielding. Determine the Upper Yield Strength (UYS) for both samples *if it is available*. Use the Autographic Diagram Method or the Halt-of-Force Method (Drop-of-the-Beam). Please refer to ASTM E8 for definition of these terms.

HOW TO REPORT DATA: For the purposes of this interlaboratory testing program, please report test results to the following precision:

Tensile Strength and Yield Strength - To nearest 0.1 ksi or 100 psi or 0.1 MPa

Elongation and Reduction of Area - Report the percentage increase to the nearest 0.1%.
If equipment can only measure to nearest 0.5%, report the data and indicate this fact on the data sheet.

Verify that pre-printed units on the data sheets are correct. If not, select and indicate one of the valid units listed on the data sheet (*ksi is the default unit for tensile strength and yield strength values*).

METALS SPECIFIC TEST INSTRUCTIONS

FASTENER WEDGE TENSILE (10°) - INCH SIZE

Analysis: 115

Pack: PX

Test Method: ASTM F606

Properties Measured: Wedge tensile strength using a 10 degree wedge.

 **Report** tensile strength; **do not report proof load values!** See the stress area calculation in ASTM F606.

Sample Information: Each sample contains four fasteners made from low alloy steel. Ignore head markings. The markings are for CTS use only and do not correlate with the sample codes.

Sample Preparation: Label each fastener with the sample codes found on the outside of the envelopes. Do not mix the two samples.

Test Procedure: Leave six threads exposed on the fastener between the grips. Measure the wedge tensile strength of three fasteners from each sample. The fourth fastener may be used for instrument setup or retest. Use one instrument and one operator for all measurements. Measure both samples on the same day.

HOW TO REPORT DATA: For the purposes of this interlaboratory testing program, please report test results to the following precision:

Wedge Tensile Strength - To nearest 0.1 ksi or 100 psi or 0.1 MPa

Verify that pre-printed units on the data sheets are correct. If not, select and indicate one of the valid units listed on the datasheet (**ksi** is the default unit for tensile strength and yield strength values).

METALS SPECIFIC TEST INSTRUCTIONS

FASTENER AXIAL TENSILE - INCH SIZE

Analysis: 116

Pack: PQ

Test Method: ASTM F606

Properties Measured: Axial tensile strength.

✎ **Report** tensile strength; **do not report proof load values!** See the stress area calculation in ASTM F606.

Sample Information: Each sample contains four fasteners made from low alloy steel. Ignore head markings. The markings are for CTS use only and do not correlate with the sample codes.

Sample Preparation: Label each fastener with the sample codes found on the outside of the envelopes. Do not mix the two samples.

Test Procedure: Leave six threads exposed on the fastener between the grips. Measure the axial tensile strength of three fasteners from each sample. The fourth fastener may be used for instrument setup or retest. Use one instrument and one operator for all measurements. Measure both samples on the same day.

HOW TO REPORT DATA: For the purposes of this interlaboratory testing program, please report test results to the following precision:

Axial Tensile Strength - To nearest 0.1 ksi or 100 psi or 0.1 MPa

Verify that pre-printed units on the data sheets are correct. If not, select and indicate one of the valid units listed on the datasheet (**ksi** is the default unit for tensile strength and yield strength values).

METALS SPECIFIC TEST INSTRUCTIONS

ROCKWELL HARDNESS: EXTERNALLY THREADED FASTENERS

Analysis: 125

Pack: PG

Test Method: ASTM F606/F606M & ASTM E18

Properties Measured: Rockwell hardness C scale.

Sample Information: Each sample contains five fasteners made from low alloy steel. Ignore head markings. The markings are for CTS use only and do not correlate with the sample codes.

Sample Preparation: Label each fastener with the sample codes found on the outside of the envelopes. Do not mix the two samples.

Test Procedure: Test four fasteners from each sample. The fifth fastener may be used for retest if needed. Cut each fastener approximately one diameter from the point end. Use the same cutting procedure for all fasteners. After sectioning a fastener there are two pieces; the shank/head piece and the smaller point piece. The point piece is the preferred location for measurements. Take four mid-radius readings approximately 90° apart on each fastener. A diagram for sample preparation can be found in ASTM F606/F606M. Use one instrument and one operator for all measurements. Measure both samples on the same day.

How to Report Data: Report the values up to the first decimal place. If your instrument only determines hardness values to the whole number, report these values.

METALS SPECIFIC TEST INSTRUCTIONS

VICKERS HARDNESS: EXTERNALLY THREADED FASTENERS

Analysis: 126

Pack: PV

Test Method: ASTM E92

Properties Measured: Vickers hardness

Sample Information: Each sample contains five fasteners made from low alloy steel. Ignore head markings. The markings are for CTS use only and do not correlate with the sample codes.

Sample Preparation: Label each fastener with the sample codes found on the outside of the envelopes. Do not mix the two samples.

Test Procedure: Test four fasteners from each sample. The fifth fastener may be used for retest if needed. Cut each fastener approximately one diameter from the point end. Use the same cutting procedure for all fasteners. After sectioning a fastener there are two pieces; the shank/head piece and the smaller point piece. The point piece is the preferred location for measurements. Take four mid-radius readings approximately 90° apart on each fastener using a test force of 20 kgf. Use one instrument, test force, and operator for all measurements. Measure both samples on the same day. If your instrument is not capable of applying a test force of 20 kgf, use 10 kgf.

How to Report Data: Report the values to the nearest whole number.

If a test force other than 20 kgf was used, record the test force in the space marked "Variations from specified procedure" on the data sheet.

METALS SPECIFIC TEST INSTRUCTIONS

FASTENER WEDGE TENSILE (10°) - METRIC

Analysis: 127

Pack: PB

Test Method: ASTM F606M

Properties Measured: Wedge tensile strength using a 10 degree wedge.

Do not report load values!

Sample Information: Each sample contains four fasteners made from low alloy steel. Ignore head markings. The markings are for CTS use only and do not correlate with the sample codes.

Sample Preparation: Label each fastener with the sample codes found on the outside of the envelopes. Do not mix the two samples.

Test Procedure: Leave six threads exposed on the fastener between the grips. Measure the wedge tensile strength of three fasteners from each sample. The fourth fastener may be used for instrument setup or retest. Use one instrument and one operator for all measurements. Measure both samples on the same day.

HOW TO REPORT DATA: For the purposes of this interlaboratory testing program, please report test results to the following precision:

Wedge Tensile Strength - To nearest 1 MPa

Verify that pre-printed units on the data sheets are correct. If not, select and indicate one of the valid units listed on the datasheet (***MPa** is the default unit for tensile strength and yield strength values*).

METALS SPECIFIC TEST INSTRUCTIONS

FASTENER AXIAL TENSILE - METRIC

Analysis: 128

Pack: PT

Test Method: ASTM F606M

Properties Measured: Axial tensile strength. **Do not report load values!**

Sample Information: Each sample contains four fasteners made from low alloy steel. Ignore head markings. The markings are for CTS use only and do not correlate with the sample codes.

Sample Preparation: Label each fastener with the sample codes found on the outside of the envelopes. Do not mix the two samples.

Test Procedure: Leave six threads exposed on the fastener between the grips. Measure the axial tensile strength of three fasteners from each sample. The fourth fastener may be used for instrument setup or retest. Use one instrument and one operator for all measurements. Measure both samples on the same day.

HOW TO REPORT DATA: For the purposes of this interlaboratory testing program, please report test results to the following precision:

Axial Tensile Strength - To nearest 1 MPa

Verify that pre-printed units on the data sheets are correct. If not, select and indicate one of the valid units listed on the datasheet (**MPa** is the default unit for tensile strength and yield strength values).

METALS SPECIFIC TEST INSTRUCTIONS

FASTENER DOUBLE SHEAR

Analysis: 129

Pack: PZ

Test Method: NASM 1312-13. If you use a different test method that is comparable to NASM 1312-13, note this on the data sheets.

Properties Measured: Individual Ultimate Load.

Sample Information: Each sample contains five fasteners made from low alloy steel. Ignore head markings. The markings do not correlate with the sample codes.

Sample Preparation: Label each fastener with the sample codes found on the outside of the envelopes. Do not mix the two samples.

Test Procedure: For this test please apply your load at a uniform rate of 22,000lb/min. Test three fasteners from each sample. The 4th and 5th fasteners may be used for instrument setup or retest if needed. Use one instrument and one operator for all measurements. Measure both samples on the same day.

How to Report Data: Report load values to the whole number. (*Lb is the default unit for this test*)

METALS SPECIFIC TEST INSTRUCTIONS

CASE DEPTH

Analysis: 145 - 146

Pack: PC

Test Method: SAE J423, J78. If you use a different test method that is comparable to J423, note this on the data sheets.

Properties Measured: Total Case Depth, Effective Case Depth (The hardness criterion is 50 HRC). Participants may report data for only one or for both two properties. CTS does not require participants to report Case Depth Hardness.

Sample Information: The two 3/4" diameters, 1" long samples are made from AISI 8620 steel and have carbonitrided case.

Sample Preparation: Prepare each specimen using your normal sample preparation procedure appropriate for a method you are using (visual, mechanical, chemical).

Test Method: After preparing the samples, test them according to SAE J423. Use one instrument and one operator for all measurements. Measure both samples on the same day. Please report the results of five (5) measurements for each sample. This is maximum number of replicates that will be accepted per sample. If you unable to make five measurements please report as many as you can.

HOW TO REPORT DATA: For the purposes of this interlaboratory testing program, please report test results to the following precision:

Total Case Depth - To nearest 0.0001 in or 0.001 mm.

Effective Case Depth - To nearest 0.001 in or 0.01 mm.

If you are unable to report to the precision above, please report with the precision that is allowed by your instrument.

METALS SPECIFIC TEST INSTRUCTIONS

MICROHARDNESS (HK500, HK200, & HV500)

Analysis: 121 - 123

Pack: PS

Test Method: ASTM E384

Properties Measured: Determine the microhardness of two samples using a Knoop indenter and/or a Vickers indenter. CTS does not require participants to report for all three indenter/load configurations.

Test Parameters: Participants may report data for one, two, or all three of the parameters listed below:

Knoop Indenter with a 500 gf test load
Knoop Indenter with a 200 gf test load
Vickers Indenter with a 500 gf test load

Sample Information: The hardness test blocks are made from plate tool steel and heat treated to specified hardness levels. Samples were pretested to assure homogeneity.

Sample Preparation: Prepare the pretested surface of each block using your normal sample preparation procedures. Remove enough material to ensure a flat, polished surface suitable for microhardness testing.

Test Procedure: Use one instrument and one operator for all measurements. Measure both samples on the same day. Test the side of the sample that has been pretested.

How to Report Data: Report Knoop and Vickers hardness values to the nearest whole number. There is a separate data sheet for each indenter/load. Record the data on the correct data sheet. Return all three microhardness data sheets to CTS even if one or more of the data sheets are not used.

METALS SPECIFIC TEST INSTRUCTIONS

ROCKWELL HARDNESS (C Scale)

Analysis: 118 & 120

Pack: PE

Test Method: ASTM E18

Properties Measured: Rockwell hardness C scale.

Sample Information: Each sample is a hardness test block manufactured from steel and heat treated to specified hardness levels.

Sample Preparation: The samples are ready to test; do not refinish the samples.

Test Procedure: Use one instrument and one operator for all measurements. Measure both samples on the same day. Test the side of the sample that has been pre-tested.

How to Report Data: Report the values up to the first decimal place. If your instrument only determines hardness values to the whole number, report these values.

METALS SPECIFIC TEST INSTRUCTIONS

ROCKWELL HARDNESS (B Scale)

Analysis: 118 - 119

Pack: PN

Test Method: ASTM E18

Properties Measured: Rockwell hardness B scale.

Sample Information: Each sample is a hardness test block manufactured from brass or steel and heat treated to specified hardness levels.

Sample Preparation: The samples are ready to test; do not refinish the samples.

Test Procedure: Use one instrument and one operator for all measurements. Measure both samples on the same day. Test the side of the sample that has been pre-tested.

How to Report Data: Report the values up to the first decimal place. If your instrument only determines hardness values to the whole number, report these values.

METALS SPECIFIC TEST INSTRUCTIONS

BRINELL HARDNESS (HBW Scale)

Analysis: 135

Pack: PD

Test Method: ASTM E10

Properties Measured: Brinell hardness

Sample Information: Each sample is a hardness test block manufactured from steel and heat treated to specified hardness levels.

Sample Preparation: The samples are ready to test; do not refinish the samples.

Test Procedure: Test both samples using a 3000 kg load and a 10 mm diameter tungsten carbide ball. Apply the full test force for 10 to 15 seconds. Use one instrument and one operator for all measurements. Measure both samples on the same day. Test the side of the sample that has been pretested.

How to Report Data: Report the values up to the first decimal place. If your instrument only determines hardness values to the whole number, report these values.

METALS SPECIFIC TEST INSTRUCTIONS

ROCKWELL SUPERFICIAL HARDNESS (30N Scale)

Analysis: 136

Pack: PH

Test Method: ASTM E18

Properties Measured: Rockwell superficial hardness 30N scale.

Sample Information: Each sample is a hardness test block manufactured from steel and heat treated to specified hardness levels.

Sample Preparation: The samples are ready to test; do not refinish the samples.

Test Procedure: Use one instrument and one operator for all measurements. Measure both samples on the same day. Test the side of the sample that has been pre-tested.

How to Report Data: Report the values up to the first decimal place. If your instrument only determines hardness values to the whole number, report these values.

METALS SPECIFIC TEST INSTRUCTIONS

CHEMICAL ANALYSIS

Analysis: 150 – 157 - **NICKEL-BASED ALLOY** (Pack: **CJ**)

Analysis: 160 – 167 - **COPPER-BASED ALLOY** (Pack: **CK**)

Analysis: 170 – 179 - **CARBON & LOW ALLOY STEEL** (Pack: **CL**)

Analysis: 180 – 189 - **CORROSION RESISTANT STEEL** (Pack: **CM**)

Properties Measured: Determine the percentage of the elements listed on the data sheet. DO NOT report data for an element that your facility typically does not analyze or is outside of your calibrated range. CTS does not require participants to report for all elements.

Sample Information: The sample alloys are listed on the data sheets.

Test Parameters: Make three determinations per element, taking each measurement from a different area of the sample. IMPORTANT: Use the same test method for all determinations of a particular element in both samples!

How to Report Data: Data reported as "<" or "0.000" cannot be included in the report. Use the following guidelines to determine the maximum number of decimal places to be used when reporting data:

If less than 0.05% of element is present, use up to 4 decimal places.

If between 0.05% and 10% of element is present, use up to 3 decimal places.

If greater than 10% of element is present, use up to 2 decimal places.

Special Requirements: For each element, write the two letter code corresponding to the method in the small box on the data sheet.

<u>CODE</u>	<u>METHOD DESCRIPTION</u>	<u>CODE</u>	<u>METHOD DESCRIPTION</u>
AA	Atomic Absorption Spectrometry	GR	Gravimetry
BD	By Difference	IC	ICP Spectrometry
CI	Combustion/IR	IR	IR (Absorption/Detection)
CL	Colorimetry	OE	Optical Emission Spectrometry
CO	Combustion	TI	Titrimetry
CT	Combustion/Titration	UV	UV/Vis. Spectrometry
DC	DC Plasma Spectrometry	VO	Volumetric
DR	Direct Reading Optical Emission Spectrometry (DROES)	WC	Wet Chemistry (method not specified)
ED	X-Ray Fluorescence, Energy Dispersive (EDXRF)	WD	X-Ray fluorescence, Wavelength Dispersive (WDXRF)
EL	Electrochemistry	XR	X-Ray fluorescence (ED or WD not specified)
GD	Glow Discharge Spectroscopy		

IMPORTANT: Although a different method may be used for each element, the same method must be used for both samples. Both samples must be tested on the same day by one person.