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Astronuclear Laboratory

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Astronuclear

WANL-TME-406
NOVEMBER 15, 1963

(85)

SUBMITTED BY:

MASTER

Westinghouse Electric Corporation
Astronuclear Laboratory
Pittsburgh 36, Pennsylvania

INFORMATION CATEGORY	
<i>Reference</i>	<i>11/15/63</i>
Authorized Classifier	Date

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SPECIAL REVIEW FINAL DETERMINATION	Reviewer	Class.	Date
	<i>JRP</i>	<i>4</i>	<i>5-12-62</i>
	<i>[Signature]</i>		
	Class:	<i>U</i>	

SPECIFICATIONS AND DRAWINGS FOR CORE ELEMENTS - - PLUG CHANNEL CORE

(Title Unclassified)

DISTRIBUTION OF THIS DOCUMENT IS LIMITED

Classification cancelled (changed to)
by authority of *DOC*
by *H.A.C.* TIC, date *SEP 10 1973*

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AND DOWNGRADING

Westinghouse Electric Corporation

Astronuclear Laboratory

Box 10864, Pittsburgh 36, Pa
Telephone 466-6800

* Union Carbide Nuclear Co.
Y-12 Facility
P. O. Box Y
Oak Ridge, Tennessee

Subject: Core Elements - Plug Channel Core

Reference: (a) Westinghouse Astronuclear Document, WANL-TME-406

Gentlemen:

Please furnish the following materials, in the quantities indicated, in accordance with reference (a), (as revised), and the documents referenced therein.

<u>Item No.</u>	<u>Element Type By Drawing No.</u>	<u>Core Qty.</u>	<u>Spares Qty.</u>	<u>Flexural Test Requirement PDS 30061-B Sec. 6</u>	<u>Total Qty.</u>
a. For basic core and associated specification					
1	909E336HO1	1584	158	80	1822
2	909E337HO1	42	10	3	55
3	909E378HO1	195	20	10	225
4	909E379HO1	94	10	5	109
b. For instrumentation back-up					
5	909E378HO1	50	5	-	55

Delivery of the above is to be made to the destination specified in reference (a) prior to 25 August, 1963. Partial deliveries are to be made as soon as possible.

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Astronuclear Laboratory
P. O. Box 10864
Pittsburgh 36, Pa.

Description and Requirements

GRAPHITE CORE ELEMENTS

Examined:

Approved:

REVISIONS

Ltr.	Date	Initials	Ltr.	Date	Initials	Ltr.	Date	Initials

This document consists of a cover sheet and pages 1 to 12 inclusive.

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1. SCOPE

The instructions covered by this specification apply to unloaded graphite core elements of the type produced by Union Carbide Nuclear Co., Y-12 Facility (hereinafter designated UCNC, Y-12), Post Office Box Y, Oak Ridge, Tennessee, for end use by Westinghouse Electric Corporation, Astronuclear Laboratory (hereinafter designated WANL), Post Office Box 10864, Pittsburgh 36, Pennsylvania.

2. APPLICABLE DOCUMENTS

2.1 The following standards, specifications, publications, and drawings or such portions thereof as designated herein of the issue in effect on the date of initiation for bids, approval request, or similar documents form a part of this specification. (All documents apply in their entirety unless elsewhere noted.)

Standards

Military

MIL-STD-105	Sampling Procedures and Tables for Inspection by Attributes
MIL-STD-129	Marking for Shipment and Storage
MIL-STD-354	Temperature and Humidity Test for Use in Production of Fuses

Specifications

Westinghouse Astronuclear Laboratory

PDS 30046	Graphite Flour
PDS 30061 -B	Oak Ridge Extruded Graphite Elements
WANL-QC-101A	Requirements for NRX-A Cold Flow and Vib. II
PS 294506	Supplementary Manufacturing Information
PS 294517	Part Identification
WANL	Element Date Preparation Requirements (unnumbered) from either WANL-TME-406 or WANL-TME-438

Union Carbide Nuclear Company, Y-12 Facility

UCNC Y-12	Manufacturing Process Specification for NRX-A1 Cold Flow Core
UCNC Y-12	Inspection Process Outline, NRX-A1 Cold Flow Core
UCNC Y-12	Packing Procedure for Unloaded Graphite Elements
UCNC Y-12	Radiographic Inspection Procedure
UCNC Y-12	Radiographic Specification for WANL Cold Flow Core, Table II

Drawings

WANL Drawings referenced in the cover letter for this specification.

(Copies of standards, drawings, specifications, and publications required by contractors in connection with specific procurement functions should be obtained from the procuring activity or as directed by the initiating officer.)

3. REQUIREMENTS

3.1 Description. - The core elements referred to herein are unloaded graphite core elements used in the NRX-A1 reactor.

3.2 General Requirements

3.2.1 Preproduction Samples. - Unless otherwise specified in the contract or order, a preproduction sample of the core elements shall be manufactured using the methods and procedures proposed for the production lot. This sample shall be tested as specified in Section 4 herein and is for the purpose of determining that the production meets the requirements of this specification and the design. Provision of the sample shall be in accordance with 4.2.1.

3.2.2 Materials. - Unless otherwise specified in the contract, letter, requisition, or order, all materials and purchased parts entering into the final assembly (unit) of the core elements shall conform strictly to the detailed requirements indicated on the drawing and specifications listed herein.

- 3.2.3 Finishes, Coatings, Construction, and Dimension. - Finishes, coatings, construction, and dimensions for the core elements shall be such as to insure meeting the requirements of the applicable drawings and this specification.
- 3.2.4 Marking. - Marking of parts shall be in accordance with the applicable drawings and this specification.
- 3.2.5 Interchangeability. - Component parts of assembled units (unless otherwise specified on the applicable drawings) fabricated in strict accordance with their applicable drawings shall be interchangeable and shall assemble with mating components of the unit without selection or fitting. If, during assembly of the fabricated parts of a unit, selection or fitting is required and changes in dimensions are necessary, no changes in the parts as delineated on applicable drawings will be made without prior revisions and correction of the applicable drawings. See 3.2.7 for deviation requests.
- 3.2.6 Gages. - The supplier shall provide himself with whatever gages are necessary and adequate to insure that the material to which this specification applies will meet the dimensional requirements shown on the applicable drawings. If so stipulated in the contract, order, or requisition, the Westinghouse Astronuclear Laboratory will furnish drawing of pertinent Westinghouse Final Inspection Gages for guidance in the design of the supplier's inspection gages. However, such procedure shall not serve to relieve the supplier of his responsibility in the design and manufacture of such gages as may be required for the satisfactory fulfillment of the contract requirements, but is intended to facilitate acceptance of items by Westinghouse Final Inspection Gages.
- 3.2.7 Requests for Deviation. - Requests for deviation from this specification; applicable drawings, specifications, publications, materials, and processes specified herein, shall be made in writing by the supplier referencing this paragraph of this specification and documents to which the deviation requested is applicable.

- 3.2.8 Conflicting Requirements. - Conflicting requirements arising between this specification and any specifications, publications, or drawings listed herein shall be referred in writing to the procuring agent for interpretation, clarification, and resolution.

3.3 Definitions

- 3.3.1 Serialization. - Element serialization shall be as described on the drawing for each item. Vendor code designation will not appear in the serialization engraved on elements produced under this contract.
- 3.3.2 Rounding of Numbers. - In addition to WANL Process Specification 294506 applying, rounding of numbers shall be as follows:
- a) If the last digit is 5, the number shall be rounded to the even number.
 - b) If the last digit is less than 5, round to the lower number.
 - c) If the last digit is greater than 5, round to the higher number.
- 3.3.3 Element Density. - Element density shall be measured by weighing complete finished elements and dividing the weight obtained by a calculated average volume.
- 3.3.4 Particle Size Distribution. - Particle size distribution is based on Tyler Standard Scale Sieves as follows:

Mesh	Weight %
+65	2 max.
-65/+100	4+2
-100/+140	15+2
-140/+200	21+2
-200/+270	13+2
-270/+325	10+2
-325	35+2

- 3.4 Performance Requirements and Product Characteristics. - The core elements shall meet the following performance requirements and product characteristics:

3.4.1 Purity. - The unfueled graphite elements specified herein shall be made from Great Lakes 1008 (purified) graphite flour. This flour shall be ground from high density (not less than 1.65 gms/cc) graphite manufactured from isotropic (Texas Lockport) coke. The purity specifications (impurities determination shall be made by ashing a sample and subjecting to emission spectroscopy) shall be as follows:

3.4.1.1 Less than 300 ppm ash

3.4.1.2 Less than 100 ppm iron

3.4.1.3 Less than 150 ppm silicon

3.4.1.4 Less than 3 ppm boron

3.4.2 Density. - Element density shall be measured by weighing complete finished elements and dividing the weight obtained by a calculated average volume. This density shall appear on the data sheet containing the density calculations of which four (4) copies are to be supplied to Westinghouse Astronuclear Laboratory.

3.4.3 Test reports shall be supplied containing results of testing in 3.4.1

3.5 Clean-Up. - Prior to preparation for shipment, all units shall be thoroughly cleaned of all foreign material.

3.6 Workmanship. - The items, including all containers and data, shall be constructed and finished in a manner to assure compliance with all requirements of this specification. Particular attention shall be paid to neatness and thoroughness of the completed item.

4. QUALITY ASSURANCE PROVISIONS AND TEST REQUIREMENTS

4.1 Inspection

4.1.1 Supplier Inspection. - Unless otherwise required by the procuring activity, the supplier is responsible for the performance of all tests and examinations to assure that the units delivered to Westinghouse are in full accordance

[REDACTED]

with all applicable requirements. In addition, the supplier is required to maintain records of all tests and examinations performed and to make the records available to the Westinghouse representative upon request.

4.1.2 Westinghouse Inspection. - The Westinghouse representative will examine the supplier's records and processes and will witness or perform examinations and tests as are deemed necessary to assure that the items are in accordance with the applicable requirements.

4.1.2.1 General Requirements Inspection. - Inspection for conformance of the core elements to the general requirements of 3.2 shall be conducted in accordance with the acceptance inspection instructions issued by the procuring activity to the Westinghouse inspector.

4.2 Sampling. - Unless otherwise specified, and when applicable, the sampling plans and procedures used by the Westinghouse inspector in the determination of the acceptability of products submitted by a supplier for Westinghouse inspection shall be in accordance with the provisions set forth in MIL-STD-105. Unless otherwise specified in the contract, order, requisition, or equivalent document, all samples for test purposes shall be provided at the expense of the contractor.

4.2.1 Preproduction Sample. - Unless otherwise specified for each contract, order, or equivalent document, a representative sample of two core elements shall be manufactured using the methods and procedures proposed for the production lot. These shall be submitted to the Westinghouse inspector for preproduction tests at an activity designated in the contract or by Westinghouse for purposes of determining compliance with the requirements of the contract, specification(s), and drawings. Further production of the item by the supplier prior to the approval of Westinghouse or the completion of tests on pre-production samples shall be at the supplier's risk.

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- 4.2.2 Periodic Production Sample. - From each lot or grand lot of 100 or less, a random sample of two items will be selected by the Westinghouse inspector for submission to the Westinghouse designated activity to determine compliance of the sample with the requirements of the contract, specifications, and drawings. The sample shall be considered satisfactory only if the platform meets the performance requirements and product characteristics of 3.4 and the environmental requirements of 3.5.
- 4.2.3 Lot Size - As applied to Westinghouse inspection units of product, the term "lot" shall mean "inspection lot", i.e., a collection of units of product submitted by a supplier for Westinghouse inspection. Unless otherwise specified, the number of units of product in "inspection lot" will be determined by the Westinghouse inspector and may differ from the quantity designated in the contract, order, or equivalent document in a lot for production, shipment, or other purpose.
- 4.3 Classification of Tests. - The inspection and testing of the core elements shall be classified as follows:
- 4.3.1 Acceptance Tests. - These tests are to be accomplished on the items being submitted for acceptance under the contract. Inspection and test procedures shall be submitted for Westinghouse approval prior to commencement of production. Acceptance tests shall be performed by the supplier in the presence of the Westinghouse inspector. These tests are defined in 4.5.
- 4.3.2 Preproduction and periodic production tests are those which are accomplished on samples selected as specified in 4.2.1 and 4.2.2 which are representative of the production of the item after the award of the contract (or equivalent order) to determine that the lot and production meet the requirements of this specification. These tests are detailed in 4.5 and 4.6. Failure of a sample to comply with these requirements will result in the rejection of the lot or cessation of production as determined by the procuring activity.

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4.4 Test Equipment. - The items of test equipment required to perform the acceptance tests set forth in the specification shall be as follows:

- (1) Complete set of equipment listed on WANL Drawing 909E334.
- (2) NORELCO 150 X-Ray Generator 10-50 KV with beryllium window.

4.5 Acceptance Tests

4.5.1 Test Performance. - The supplier shall conduct acceptance tests in the presence of the Westinghouse inspector as specified in 4.3.1 to assure compliance with the requirements of 3.2 and 3.4.

4.5.2 Test Conditions. - Unless otherwise specified, the procedure to 4.5.4 shall be accomplished under the following conditions:

4.5.2.1 Temperature. - Room ambient 65 to 95°F. (18 to 35°C.), unless otherwise specified.

4.5.2.2 Altitude. - Normal ground.

4.5.2.3 Vibration. - None

4.5.2.4 Humidity. - Room ambient to 95 per cent relative maximum.

4.5.3 Test and Inspection Equipment and Facilities. - The supplier shall furnish and maintain all necessary test equipment, facilities, and personnel for performing all acceptance tests. The test equipment shall be adequate in quality, and when definite requirements are not specified they shall be of sufficient accuracy and quality to permit performance of the required acceptance tests.

4.5.4 Test Procedure. - The test procedure shall be accomplished in accordance with the pertinent instructions set forth in Westinghouse Astronuclear Laboratory (WANL) Document.

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- 4.6 Acceptance Criteria. - An item which fails to meet any of the performance requirements, product characteristics, or environmental requirements of this specification shall be regarded as defective.

5. PREPARATION FOR DELIVERY

- 5.1 Packaging and Packing. - The core elements shall be packaged and packed in a container with the basic construction and dimensions shown in Figure 5-1 and in accordance with the instructions set forth below.

The referenced figure illustrates the shipping container which shall be used for the shipment of unloaded graphite elements. Each container shall be made from two (2) 18-gauge steel, 55 gallon drums cut and welded as shown. The lid is 16-gauge steel secured with a 12-gauge bolt-type sealing ring with forged lug. Both ends of the container shall be padded with one-inch thick foam rubber.

- 5.1.1 Elements shall be packed in layers. Each layer shall be insulated from the drum walls and from the next layer by one or more thicknesses of soft 10-ply packing paper.
- 5.1.2 All materials described herein are to be shipped prior to the date specified in the letter on document referencing this specification. Partial deliveries may be made as soon as practicable.
- 5.1.3 Materials are to be shipped by railraod express, prepaid, controlled signature service unless otherwise directed by WANL.
- 5.1.4 Materials shipped are to be addressed to:

Westinghouse Electric Corporation
Astronuclear Laboratory
Route 51
Large, Pennsylvania

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- 5.1.5 All elements delivered and rejected as not conforming to the requirements of applicable specifications are to be reserved for WANL disposition. Such elements when designated by WANL are to be packed, specially labeled and shipped in a manner similar to acceptable elements. WANL must designate disposition within a reasonable time after being informed of the need for disposition.
- 5.1.5.1 Unless otherwise provided for, reject elements shall be furnished in the rejected state in containers clearly labeled "reject".
- 5.1.5.2 All reject elements shipped to WANL shall have one end painted to insure identification.
- 5.1.5.3 Elements rejected for failure to meet the radiographic specification shall have one end painted to insure identification.
- 5.1.5.4 Elements rejected for failure to meet the radiographic specification shall be separated from elements rejected for other reasons. In addition to other packing requirements, each container for these elements shall be marked:

RADIOGRAPHIC REJECT

- 5.1.5.5 UCNC, Y-12 shall provide WANL with the equivalent diameter, determined by a WANL approved flow testing procedure of each flow channel of the core elements. Data tabulation will be provided WANL on complete punch cards and also on magnetic tape. A description of the required punch-card format for element data is presented in WANL Element Data Preparation of the print-out.
- 5.1.6 Prior to packing, each element shall be enclosed in a length of 2" tabular polyethylene protective wrapping material, a sample of which will be supplied by WANL. Each tube end shall be sealed by application of sufficient heat to cause welding of the wrapper ends to insure that a clean element condition is maintained during shipment.

5.2 Marking

5.2.1 Normal Marking. - In addition to the markings required by the contract, order, or equivalent document, the unit packages shall be marked in accordance with the requirements of MIL-STD-129.

6. NOTES

6.1 Intended Use. - The core elements referenced to in this specification are intended for use in the NRX-A1 reactor test program.

6.2 Operating Data. - Procurement documents should specify the following:

- a) Title, number, and date of this specification
- b) Level packaging and packing.

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Figure 5-1 Shipping Container

- NOTE - 1. 6 SHIPPING CONTAINERS REQUIRED
2. FABRICATE FROM 55 GAL B.I. DRUMS (12 B. I. DRUMS REQ' D.)
3. SUPPORTS 1 1/2" B. I. ANGLE

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ACTUAL SIZE

TABLE I RADIOGRAPHIC ACCEPTANCE LIMITS		
DEFECT	AXIAL LENGTH	TRANSVERSE LENGTH
CRACKS	(1) UP TO TEN (10) WHOSE LENGTH EACH SHALL NOT EXCEED .250	NO TRANSVERSE CRACKS PERMITTED SEE NOTE 11
	(2) CRACK WIDTH SHALL NOT EXCEED .010	
	(3) NO TRANSVERSE PROJECTION GREATER THAN .060	
VOIDS	UP TO TEN (10) WITH A MAXIMUM DIMENSION EXCEEDING .080 BUT LESS THAN .060 WITH A MINIMUM SPACING OF .250	
INCLUSIONS

VIEW A-A
SCALE B/1

13- ITEMS 2 THRU 36 ARE MADE FROM ITEM 1

12- SURFACE DEFECTS OTHER THAN VISIBLE CRACKS ARE PERMITTED ANYWHERE ON THE ELEMENT. P.T.O. 12 INCH MAJOR DIMENSION AND .010 DEEP. ACCEPTANCE MAY BE DETERMINED BY VNCV Y12 STANDARD NO. SF 002

11- A TRANSVERSE CRACK IS DEFINED AS ANY CRACK FALLING FROM 45 TO 90 DEGREES TO THE LONG AXIS OF THE ELEMENT

10- ELEMENT TO HAVE NO FUEL LOADING

9- MEASURE EQUIVALENT DIA OF .0960 DIA HOLES BY AIR FLOW AFTER BROACHING AND CUTTING TO LENGTH

8- END CHIPS WILL BE ACCEPTED THAT EXTEND NO MORE THAN 1/16 INCH AXIALLY FROM FACE B OR 1/8 INCH AXIALLY FROM FACE C

7- .0960 DIA HOLES TO BE MEASURED BY A .010 INCH AIR PROBE. HOLE LOCATIONS TO BE WITHIN .012 RADIUS OF TRUE POSITION EXCEPT DISPLACEMENT OF OUTER HOLES TOWARDS OUTER SURFACES LIMITED TO .006

6- LOCATE ORIENTATION NOTCH BETWEEN HOLES AS SHOWN. NOTCH MUST NOT BREAK INTO .096 DIA HOLES

5- ELEMENT TO BE EXTRUDED, CURED AND GRAPHITIZED TO AN OPTICALLY OBSERVED TEMPERATURE OF AT LEAST 2300 °C

4- PERFORM RADIOGRAPHY IN THREE ORIENTATIONS 120 DEGREES APART, OVER ENTIRE LENGTH OF ELEMENT. RADIOGRAPHIC FILM APPROPRIATELY IDENTIFIED SHALL BE MAINTAINED FOR 8 MONTHS

3- RADIOGRAPHICALLY INSPECT PER UNION CARBIDE CORP. Y12 PLANT DOCUMENT NO. R-3 REV A. SEE TABLE I FOR ACCEPTANCE LIMITS. DEFECTS SHALL NOT BREAK THROUGH ANY SURFACE

2- SURFACE FINISH SHALL NOT EXCEED 200 MICROINCHES (A.A.)

1- THIS PART IS SIMILAR TO DWG E-2 46056 OF UNION CARBIDE CORPORATION Y12 PLANT OAK RIDGE, TENN

REV	DESCRIPTION	DATE	BY
A1	ADDED SHEETS 2 THRU 5	8/24/63	W. J. B.
A2	ADDED ITEMS 2 THRU 37 ORIGINAL PART NO REV. 5 A	8/24/63	JR LOBB
A3	ADDED NOTE 13	8/24/63	
A4	PART NO REV OF ITEM 1 NOT AFFECTED	8/24/63	
A5	IDENTITY WAS PART IDENT	8/24/63	
A6	ECO 10368 D751487-A-GAM	8/24/63	
B1	SHEET 2	8/24/63	
B2	ADDED ITEM 38 TO TABULATION BLOCK	8/24/63	
B3	ADDED ITEM 38	8/24/63	
B4	ORIGINAL PART NO REV IS B	8/24/63	
B5	NOTE 13 WAS ITEMS 2 THRU 37--- PART NO REV OF ITEMS 1 THRU 37 NOT AFFECTED	8/24/63	
B6	ECO 10413	8/24/63	

1	38 ELEMENT, FUEL PF	1	EA	SEE NOTE 13
31	ELEMENT FUEL PF	1	EA	SEE NOTE 13
30	ELEMENT FUEL PF	1	EA	SEE NOTE 13
35	ELEMENT FUEL PF	1	EA	SEE NOTE 13
34	ELEMENT FUEL PF	1	EA	SEE NOTE 13
33	ELEMENT FUEL PF	1	EA	SEE NOTE 13
32	ELEMENT FUEL PF	1	EA	SEE NOTE 13
31	ELEMENT FUEL PF	1	EA	SEE NOTE 13
30	ELEMENT FUEL PF	1	EA	SEE NOTE 13
29	ELEMENT FUEL PF	1	EA	SEE NOTE 13
28	ELEMENT FUEL PF	1	EA	SEE NOTE 13
27	ELEMENT FUEL PF	1	EA	SEE NOTE 13
26	ELEMENT FUEL PF	1	EA	SEE NOTE 13
25	ELEMENT FUEL PF	1	EA	SEE NOTE 13
24	ELEMENT FUEL PF	1	EA	SEE NOTE 13
23	ELEMENT FUEL PF	1	EA	SEE NOTE 13
22	ELEMENT FUEL PF	1	EA	SEE NOTE 13
21	ELEMENT FUEL PF	1	EA	SEE NOTE 13
20	ELEMENT FUEL PF	1	EA	SEE NOTE 13
19	ELEMENT FUEL PF	1	EA	SEE NOTE 13
18	ELEMENT FUEL PF	1	EA	SEE NOTE 13
17	ELEMENT FUEL PF	1	EA	SEE NOTE 13
16	ELEMENT FUEL PF	1	EA	SEE NOTE 13
15	ELEMENT FUEL PF	1	EA	SEE NOTE 13
14	ELEMENT FUEL PF	1	EA	SEE NOTE 13
13	ELEMENT FUEL PF	1	EA	SEE NOTE 13
12	ELEMENT FUEL PF	1	EA	SEE NOTE 13
11	ELEMENT FUEL PF	1	EA	SEE NOTE 13
10	ELEMENT FUEL PF	1	EA	SEE NOTE 13
9	ELEMENT FUEL PF	1	EA	SEE NOTE 13
8	ELEMENT FUEL PF	1	EA	SEE NOTE 13
7	ELEMENT FUEL PF	1	EA	SEE NOTE 13
6	ELEMENT FUEL PF	1	EA	SEE NOTE 13
5	ELEMENT FUEL PF	1	EA	SEE NOTE 13
4	ELEMENT FUEL PF	1	EA	SEE NOTE 13
3	ELEMENT FUEL PF	1	EA	SEE NOTE 13
2	ELEMENT FUEL PF	1	EA	SEE NOTE 13
1	ELEMENT FUEL PF	1	EA	SEE NOTE 13

QTY	ITEM	TER	DESCRIPTION	QTY	UNIT	REMARKS	QTY	ITEM	TER	DESCRIPTION	QTY	UNIT	REMARKS
1	38	ELEMENT FUEL PF	1	EA	SEE NOTE 13								
1	37	ELEMENT FUEL PF	1	EA	SEE NOTE 13								
1	36	ELEMENT FUEL PF	1	EA	SEE NOTE 13								
1	35	ELEMENT FUEL PF	1	EA	SEE NOTE 13								
1	34	ELEMENT FUEL PF	1	EA	SEE NOTE 13								
1	33	ELEMENT FUEL PF	1	EA	SEE NOTE 13								
1	32	ELEMENT FUEL PF	1	EA	SEE NOTE 13								
1	31	ELEMENT FUEL PF	1	EA	SEE NOTE 13								
1	30	ELEMENT FUEL PF	1	EA	SEE NOTE 13								
1	29	ELEMENT FUEL PF	1	EA	SEE NOTE 13								
1	28	ELEMENT FUEL PF	1	EA	SEE NOTE 13								
1	27	ELEMENT FUEL PF	1	EA	SEE NOTE 13								
1	26	ELEMENT FUEL PF	1	EA	SEE NOTE 13								
1	25	ELEMENT FUEL PF	1	EA	SEE NOTE 13								
1	24	ELEMENT FUEL PF	1	EA	SEE NOTE 13								
1	23	ELEMENT FUEL PF	1	EA	SEE NOTE 13								
1	22	ELEMENT FUEL PF	1	EA	SEE NOTE 13								
1	21	ELEMENT FUEL PF	1	EA	SEE NOTE 13								
1	20	ELEMENT FUEL PF	1	EA	SEE NOTE 13								
1	19	ELEMENT FUEL PF	1	EA	SEE NOTE 13								
1	18	ELEMENT FUEL PF	1	EA	SEE NOTE 13								
1	17	ELEMENT FUEL PF	1	EA	SEE NOTE 13								
1	16	ELEMENT FUEL PF	1	EA	SEE NOTE 13								
1	15	ELEMENT FUEL PF	1	EA	SEE NOTE 13								
1	14	ELEMENT FUEL PF	1	EA	SEE NOTE 13								
1	13	ELEMENT FUEL PF	1	EA	SEE NOTE 13								
1	12	ELEMENT FUEL PF	1	EA	SEE NOTE 13								
1	11	ELEMENT FUEL PF	1	EA	SEE NOTE 13								
1	10	ELEMENT FUEL PF	1	EA	SEE NOTE 13								
1	9	ELEMENT FUEL PF	1	EA	SEE NOTE 13								
1	8	ELEMENT FUEL PF	1	EA	SEE NOTE 13								
1	7	ELEMENT FUEL PF	1	EA	SEE NOTE 13								
1	6	ELEMENT FUEL PF	1	EA	SEE NOTE 13								
1	5	ELEMENT FUEL PF	1	EA	SEE NOTE 13								
1	4	ELEMENT FUEL PF	1	EA	SEE NOTE 13								
1	3	ELEMENT FUEL PF	1	EA	SEE NOTE 13								
1	2	ELEMENT FUEL PF	1	EA	SEE NOTE 13								
1	1	ELEMENT FUEL PF	1	EA	SEE NOTE 13								

QTY	ITEM	TER	DESCRIPTION	QTY	UNIT	REMARKS	QTY	ITEM	TER	DESCRIPTION	QTY	UNIT	REMARKS
1	38	ELEMENT FUEL PF	1	EA	SEE NOTE 13								
1	37	ELEMENT FUEL PF	1	EA	SEE NOTE 13								
1	36	ELEMENT FUEL PF	1	EA	SEE NOTE 13								
1	35	ELEMENT FUEL PF	1	EA	SEE NOTE 13								
1	34	ELEMENT FUEL PF	1	EA	SEE NOTE 13								
1	33	ELEMENT FUEL PF	1	EA	SEE NOTE 13								
1	32	ELEMENT FUEL PF	1	EA	SEE NOTE 13								
1	31	ELEMENT FUEL PF	1	EA	SEE NOTE 13								
1	30	ELEMENT FUEL PF	1	EA	SEE NOTE 13								
1	29	ELEMENT FUEL PF	1	EA	SEE NOTE 13								
1	28	ELEMENT FUEL PF	1	EA	SEE NOTE 13								
1	27	ELEMENT FUEL PF	1	EA	SEE NOTE 13								
1	26	ELEMENT FUEL PF	1	EA	SEE NOTE 13								
1	25	ELEMENT FUEL PF	1	EA	SEE NOTE 13								
1	24	ELEMENT FUEL PF	1	EA	SEE NOTE 13								
1	23	ELEMENT FUEL PF	1	EA	SEE NOTE 13								
1	22	ELEMENT FUEL PF	1	EA	SEE NOTE 13								
1	21	ELEMENT FUEL PF	1	EA	SEE NOTE 13								
1	20	ELEMENT FUEL PF	1	EA	SEE NOTE 13								
1	19	ELEMENT FUEL PF	1	EA	SEE NOTE 13								
1	18	ELEMENT FUEL PF	1	EA	SEE NOTE 13								
1	17	ELEMENT FUEL PF	1	EA	SEE NOTE 13								
1	16	ELEMENT FUEL PF	1	EA	SEE NOTE 13								
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1	11	ELEMENT FUEL PF	1	EA	SEE NOTE 13								
1	10	ELEMENT FUEL PF	1	EA	SEE NOTE 13								
1	9	ELEMENT FUEL PF	1	EA	SEE NOTE 13								
1	8	ELEMENT FUEL PF	1	EA	SEE NOTE 13								
1	7	ELEMENT FUEL PF	1	EA	SEE NOTE 13								
1	6	ELEMENT FUEL PF	1	EA	SEE NOTE 13								
1	5	ELEMENT FUEL PF	1	EA	SEE NOTE 13								
1	4	ELEMENT FUEL PF	1	EA	SEE NOTE 13								
1	3	ELEMENT FUEL PF	1	EA	SEE NOTE 13								
1	2	ELEMENT FUEL PF	1	EA	SEE NOTE 13								
1	1	ELEMENT FUEL PF	1	EA	SEE NOTE 13								

QTY	ITEM	TER	DESCRIPTION	QTY	UNIT	REMARKS	QTY	ITEM	TER	DESCRIPTION	QTY	UNIT	REMARKS
1	38	ELEMENT FUEL PF	1	EA	SEE NOTE 13								
1	37	ELEMENT FUEL PF	1	EA	SEE NOTE 13								
1	36	ELEMENT FUEL PF	1	EA	SEE NOTE 13								
1	35	ELEMENT FUEL PF	1	EA	SEE NOTE 13								
1	34	ELEMENT FUEL PF	1	EA	SEE NOTE 13								
1	33	ELEMENT FUEL PF	1	EA	SEE NOTE 13								
1	32	ELEMENT FUEL PF	1	EA	SEE NOTE 13								
1	31	ELEMENT FUEL PF	1	EA	SEE NOTE 13								
1	30	ELEMENT FUEL PF	1	EA	SEE NOTE 13								
1	29	ELEMENT FUEL PF	1	EA	SEE NOTE 13								
1	28	ELEMENT FUEL PF	1	EA	SEE NOTE 13								
1	27	ELEMENT FUEL PF	1	EA	SEE NOTE 13								
1	26	ELEMENT FUEL PF	1	EA	SEE NOTE 13								
1	25	ELEMENT FUEL PF	1	EA	SEE NOTE 13								
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1	23	ELEMENT FUEL PF	1	EA	SEE NOTE 13								
1	22	ELEMENT FUEL PF	1	EA	SEE NOTE 13								
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1	19	ELEMENT FUEL PF	1	EA	SEE NOTE 13								
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1	3	ELEMENT FUEL PF	1	EA	SEE NOTE 13								
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1	1	ELEMENT FUEL PF	1	EA	SEE NOTE 13								

QTY	ITEM	TER	DESCRIPTION	QTY	UNIT	REMARKS	QTY	ITEM	TER	DESCRIPTION	QTY	UNIT	REMARKS
1	38	ELEMENT FUEL PF	1	EA	SEE NOTE 13								
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1	4	ELEMENT FUEL PF	1	EA	SEE NOTE 13								
1	3	ELEMENT FUEL PF	1	EA	SEE NOTE 13								
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1	32	ELEMENT FUEL PF	1	EA	SEE NOTE 13								
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1	3	ELEMENT FUEL PF	1	EA	SEE NOTE 13								
1	2	ELEMENT FUEL PF	1	EA	SEE NOTE 13								
1	1	ELEMENT FUEL PF	1	EA	SEE NOTE 13								

QTY	ITEM	TER	DESCRIPTION	QTY	UNIT	REMARKS	QTY	ITEM	TER	DESCRIPTION	QTY	UNIT	REMARKS
1	38	ELEMENT FUEL PF	1	EA	SEE NOTE 13								
1	37	ELEMENT FUEL PF	1	EA	SEE NOTE 13								
1	36	ELEMENT FUEL PF	1	EA	SEE NOTE 13								
1	35	ELEMENT FUEL PF	1	EA	SEE NOTE 13								
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1	19	ELEMENT FUEL PF	1	EA	SEE NOTE 13								
1	18	ELEMENT FUEL PF	1	EA	SEE NOTE 13								
1	17	ELEMENT FUEL PF	1	EA	SEE NOTE 13								
1	16	ELEMENT FUEL PF	1	EA	SEE NOTE 13								
1	15

- 1- LOCATE ORIENTATION NOTCH BETWEEN HOLES AS SHOWN. NOTCH MUST NOT BREAK INTO .0960 DIA HOLES
- 10- A TRANSVERSE CRACK IS DEFINED AS ANY CRACK FALLING FROM 45 TO 90 DEGREES TO THE LONG AXIS OF THE ELEMENT
- 9- ELEMENT TO HAVE NO FUEL LOADING
- 8- SURFACE FINISH SHALL NOT EXCEED 200 MICROINCHES(AA)
- 7- END CHIPS WILL BE ACCEPTED THAT EXTEND NO MORE THAN 1/8 INCH AXIALLY FROM FACE B OR 1/8 INCH AXIALLY FROM FACE C
- 6- Ø960 DIA HOLES TO BE MEASURED BY A 6" AIR PROBE. HOLE LOCATIONS TO BE WITHIN .012 RADIAL OF TRUE POSITION EXCEPT DISPLACEMENT OF HOLES 1,2,3,4, 7, 8, 10. 12 TOWARDS OUTER SURFACES LIMITED TO .006
- 5- ELEMENT TO BE EXTRUDED CURED AND QUENCHED TO AN OPTICALLY OBSERVED TEMPERATURE OF AT LEAST 2500°C
- 4- PERFORM RADIOGRAPHY IN THREE ORIENTATIONS 120 DEGREES APART OVER ENTIRE LENGTH OF ELEMENT. RADIOGRAPHIC FILM APPROPRIATELY IDENTIFIED SHALL BE MAINTAINED FOR 18 MONTHS
- 3- SURFACE DEFECTS OTHER THAN V5 BLF CRACKS ARE PERMITTED ANYWHERE ON THE ELEMENT UP TO 125 INCH MAJOR DIMENSIONS AND 0.006 DEEP. ACCEPTANCE MAY BE DETERMINED BY UENC V-2 STANDARD NO. 5F 002
- 2- RADIOGRAPHICALLY INSPECT PER UNION CARBIDE CORP. V-12 PLANT DOCUMENT NO. R-3 REV. 5 SEE TABLE FOR ACCEPTANCE LIMITS. DEFECTS SHALL NOT BREAK THROUGH AIR SURFACE
- 1- THIS PART IS SIMILAR TO DWG E-T-46056 SIZE 3 OF UNION CARBIDE CORPORATION Y-2 PLANT, OAK RIDGE, TENN

DEFECT	AXIAL LENGTH	TRANSVERSE LENGTH
CRACKS	(1) UP TO TEN (10) WHOSE LENGTH EACH SHALL NOT EXCEED 250 (2) CRACK WIDTH SHALL NOT EXCEED 0.015 (3) NO TRANSVERSE PROJECTION GREATER THAN .060	NO TRANSVERSE CRACKS PERMITTED SEE NOTE 10
VOIDS INCLUDING INCLUSIONS	UP TO TEN (10) WITH A MAXIMUM DIMENSION EXCEEDING 0.30 BUT LESS THAN 0.60 WITH A MINIMUM SPACING OF 250	

12 - MEASURE EQUIVALENT DIA OF .0960 DIA HOLES BY AIR FLOW AFTER BROACHING AND CUTTING TO LENGTH

1	1	FUEL ELEMENT, PARTIAL PF		909E337401	CLASS
REF NO	SYM	PER NO	DESCRIPTION OR SYMBOLIC	CODE	FILE OR DESCRIPTION NO
LIST OF MATERIALS					
1	1	1	DRAW	WESTINGHOUSE ELECTRIC	FUEL ELEMENT, PARTIAL PF 909E337401
2	2	2	DRAW	COMPARTMENT	
3	3	3	DRAW		
4	4	4	DRAW		
5	5	5	DRAW		
6	6	6	DRAW		
7	7	7	DRAW		
8	8	8	DRAW		
9	9	9	DRAW		
10	10	10	DRAW		
11	11	11	DRAW		
12	12	12	DRAW		
13	13	13	DRAW		
14	14	14	DRAW		
15	15	15	DRAW		
16	16	16	DRAW		
17	17	17	DRAW		
18	18	18	DRAW		
19	19	19	DRAW		
20	20	20	DRAW		
21	21	21	DRAW		
22	22	22	DRAW		
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25	25	25	DRAW		
26	26	26	DRAW		
27	27	27	DRAW		
28	28	28	DRAW		
29	29	29	DRAW		
30	30	30	DRAW		
31	31	31	DRAW		
32	32	32	DRAW		
33	33	33	DRAW		
34	34	34	DRAW		
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36	36	36	DRAW		
37	37	37	DRAW		
38	38	38	DRAW		
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40	40	40	DRAW		
41	41	41	DRAW		
42	42	42	DRAW		
43	43	43	DRAW		
44	44	44	DRAW		
45	45	45	DRAW		
46	46	46	DRAW		
47	47	47	DRAW		
48	48	48	DRAW		
49	49	49	DRAW		
50	50	50	DRAW		
51	51	51	DRAW		
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71	71	71	DRAW		
72	72	72	DRAW		
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74	74	74	DRAW		
75	75	75	DRAW		
76	76	76	DRAW		
77	77	77	DRAW		
78	78	78	DRAW		
79	79	79	DRAW		
80	80	80	DRAW

NEW DD
SCALE 4/1

REVIEWS				
SPR	ZONE	DESCRIPTION	DATE	BY
A		ADD'D TEM 2 S A ET 2	RAU	
		OR X NAL PART NO REV 5 A	0 1 63	JR LO
B4		ADDED NOTE 1		
A2		DENT WAS PART DENT		
		FACT NO R V L F TEM NOT		
		F FECTED		
		ECC 0379		
			0 2 63	Blawie

VIEW B-B
SCALE 4/1

SECTION C C
SCALE 4/1

DETAIL - A
SCALE 4"=1'

TABLE I
RADIOGRAPH C ACCEPTANCE LIMITS

DEFECT	AXIAL LENGTH	TRANSVERSE LENGTH
CRACKS	(1) UP TO TEN (10) WIDOWE LENGTH EACH SHALL NOT EXCEED 250 (2) CRACK WITH SHALL NOT EXCEED 010 (3) TRANSVERSE PROJECTION SHALL NOT EXCEED 030	NO CRACKS PERMITTED SEE NOTE 9
VOIDS	NOT MORE THAN TEN (10) GREATER THAN 050 BUT LESS THAN 010 MAJOR DIMENSION WITH A MIN SPACING OF 250 IN	
INCLUSIONS		

- 11- ITEM 2 MADE FROM ITEM 1
- 10- SURFACE DEFECTS OTHER THAN VISIBLE CRACKS ARE PERMITTED ANYWHERE ON THE ELEMENT UP TO .125 INCH MAXIMUM DIMENSION AND 0 DEEP. ACCEPTANCE MAY BE DETERMINED BY UCONC Y12 STANDARD NO SF-001
- 9- A TRANSVERSE CRACK IS DEFINED AS ANY CRACK FALLING FROM .45 TO .90 DEGREE TO THE LONG AXIS OF THE ELEMENT
- 8- 1000 DIA HOLE LOCATION TO BE SUCH THAT NO HOLE BREAKS THROUGH INTO ANOTHER SIDE THROUGH A .5 DE SURFACE
- 7- END CHIPS WILL BE ACCEPTED THAT EXTEND NO MORE THAN .06 AXIALLY FROM FACE D OR .125 AXIALLY FROM FACE E. NO CHIPS PERMISSIBLE AT FACE F.
- 6- LOCATE ORIENTATION NOTCH BETWEEN HOLES AS SHOWN. NOTCH MUST NOT BREAK INTO 1000 DIA HOLES
- 5- ELEMENT TO BE EXTRUDED CURED AND GRAPHITIZED TO AN OPTICALLY OBSERVABLE GLOSS FINISH THROUGHOUT 2800 °C.
- 4- PERFORM RADIOGRAPHY IN THREE ORIENTATIONS. 120 DEGREES APART OVER ENTIRE LENGTH OF ELEMENT. RADIOGRAPHIC FILM APPROPRIATELY IDENTIFIED SHALL BE MAINTAINED FOR 18 MONTHS
- 3- RADIOGRAPHICALLY INSPECT PER UNION CAREBIDE CORP Y-12 DOCUMENT NO 2245. SEE TABLE 1 FOR ACCEPTANCE LIMITS. DEFECTS SHALL NOT BREAK THROUGH ANY SURFACE.
- 2- SURFACE FINISH SHALL NOT EXCEED 200 MICROINCHES (A.A)
- 1- THIS PART IS EQUIVALENT TO DWG O K 92-045 OF UNION CAREBIDE CORP Y-12 PLANT OAK RIDGE TENN

1	2	ELEMENT UNFILED (P/P)		POSTSTENOGRAPHIC NOTE II	
3	4	ELEMENT UNFILED (P/P)		SECRETARY'S OFFICE	
5	6	INVESTIGATION OF SUBJECT		PART OF	
7	8	SUBJECT		RECORDING NO.	
9	10	RECORDING NO.		RECORDING NO.	
11	12	RECORDING NO.		RECORDING NO.	
13	14	RECORDING NO.		RECORDING NO.	
15	16	RECORDING NO.		RECORDING NO.	
17	18	RECORDING NO.		RECORDING NO.	
19	20	RECORDING NO.		RECORDING NO.	
21	22	RECORDING NO.		RECORDING NO.	
23	24	RECORDING NO.		RECORDING NO.	
25	26	RECORDING NO.		RECORDING NO.	
27	28	RECORDING NO.		RECORDING NO.	
29	30	RECORDING NO.		RECORDING NO.	
31	32	RECORDING NO.		RECORDING NO.	
33	34	RECORDING NO.		RECORDING NO.	
35	36	RECORDING NO.		RECORDING NO.	
37	38	RECORDING NO.		RECORDING NO.	
39	40	RECORDING NO.		RECORDING NO.	
41	42	RECORDING NO.		RECORDING NO.	
43	44	RECORDING NO.		RECORDING NO.	
45	46	RECORDING NO.		RECORDING NO.	
47	48	RECORDING NO.		RECORDING NO.	
49	50	RECORDING NO.		RECORDING NO.	
51	52	RECORDING NO.		RECORDING NO.	
53	54	RECORDING NO.		RECORDING NO.	
55	56	RECORDING NO.		RECORDING NO.	
57	58	RECORDING NO.		RECORDING NO.	
59	60	RECORDING NO.		RECORDING NO.	
61	62	RECORDING NO.		RECORDING NO.	
63	64	RECORDING NO.		RECORDING NO.	
65	66	RECORDING NO.		RECORDING NO.	
67	68	RECORDING NO.		RECORDING NO.	
69	70	RECORDING NO.		RECORDING NO.	
71	72	RECORDING NO.		RECORDING NO.	
73	74	RECORDING NO.		RECORDING NO.	
75	76	RECORDING NO.		RECORDING NO.	
77	78	RECORDING NO.		RECORDING NO.	
79	80	RECORDING NO.		RECORDING NO.	
81	82	RECORDING NO.		RECORDING NO.	
83	84	RECORDING NO.		RECORDING NO.	
85	86	RECORDING NO.		RECORDING NO.	
87	88	RECORDING NO.		RECORDING NO.	
89	90	RECORDING NO.		RECORDING NO.	
91	92	RECORDING NO.		RECORDING NO.	
93	94	RECORDING NO.		RECORDING NO.	
95	96	RECORDING NO.		RECORDING NO.	
97	98	RECORDING NO.		RECORDING NO.	
99	100	RECORDING NO.		RECORDING NO.

DEFECTS	AXIAL LENGTH	TRANSVERSE LENGTH
CRACKS	(1) UP TO TEN (10) WHOSE LENGTH EACH SHALL NOT EXCEED 150 (2) CRACK WHOSE LENGTH NOT EXCEED 030 (3) TRANSVERSE PROJECTION SHALL NOT EXCEED 030	NO TRANSVERSE CRACKS PERMITTED SEE NOTE 6
VOIDS	NOT MORE THAN TEN (10) GREATER THAN 030 BUT	LESS THAN 060
INCLUSIONS	MAJOR DIMENSION WITH A MINIMUM SPACING OF 250	

[illegible]

Westinghouse Electric Corporation
Astronuclear Laboratory
P. O. Box 10864
Pittsburgh 36, Pa.

TENTATIVE SPECIFICATION

PURCHASING DEPARTMENT SPECIFICATION 30046

December 11, 1962

GRAPHITE FLOUR

SCOPE

1. This specification covers high purity graphite flour.

<u>SPEC</u> <u>Designation</u>	<u>Description</u>
30046-1	High density graphite flour having detailed particle size distribution.

2. No change shall be made in the quality of successive shipments of material furnished under this specification without first obtaining the approval of the purchaser.

MANUFACTURE

3. Stock shall be ground from high density (not less than 1.65 gms/cc) graphite manufactured from isotropic (Texas Lockport) coke.

CHEMICAL PROPERTIES

4. Purity specifications shall be as follows:

- (4.1) Less than 300 ppm ash
- (4.2) Less than 100 ppm iron
- (4.3) Less than 150 ppm silicon
- (4.4) Less than 3 ppm boron

Determination of impurities shall be as follows. A sample shall be ashed and impurities determined by emission spectroscopy.

PD SPEC 30046

PHYSICAL PROPERTIES

5. The desired detailed particle size distribution based on Tyler Standard Scale Sieves is as follows:

Mesh	+65	-65/+100	-100/+140	-140/+200	-200/+270	-270/+325	-325
Weight %	2 max.	4 $\pm$ 2	15 $\pm$ 2	21 $\pm$ 2	13 $\pm$ 2	10 $\pm$ 2	35 $\pm$ 2

6. One composite drum of this material shall be shipped to WANL for evaluation before the lot is accepted for shipment.

TEST REPORTS

7. The manufacturer shall furnish four copies of test reports containing the results of the testing required by sections three through five.

SHIPMENT

8. The ground flour should be shipped in clean, tight, 55-gallon drums.

SOURCE SURVEILLANCE

9. SOURCE SURVEILLANCE:

(9.1) Material covered by this specification is subject to source surveillance by a Westinghouse Quality Representative. This will include surveillance of the products and of the seller's systems, procedures, and facilities which relate to the manufacture and inspection of materials specified in the applicable procurement documents. The seller shall furnish, at no cost, necessary facilities and equipment to perform tests and supply data as required by applicable drawings, specifications, and the purchase order under surveillance of the Westinghouse Quality Representative.

- (9.2) Material accepted by the purchaser's inspector at the place of manufacture which subsequently reveals imperfection not detected at the place of manufacture, or which subsequent tests or analyses show not to be in accordance with this specification, is subject to rejection.

Westinghouse Electric Corporation
Astronuclear Laboratory
P. O. Box 10864
Pittsburgh 36, Pa.
(Fed. Ident. Code No. 14683)

PURCHASING DEPARTMENT SPECIFICATION 30061-B
(Not for Publication)

TENTATIVE SPECIFICATION
April 25, 1963

OAK RIDGE EXTRUDED GRAPHITE ELEMENTS

1. SCOPE

This specification covers graphite elements to be made at Y-12. These elements shall be extruded, unfueled, uncoated, broached or milled, and reamed.

2. CONSISTENT QUALITY

No change shall be made in the manner of processing or in the quality of successive shipments of material furnished under this specification without first obtaining approval of WANL.

3. APPLICABLE DOCUMENTS

The following specifications are incorporated, to the extent specified herein, as an integral part of this specification:

WANL PDS 30046

4. MANUFACTURE

The unfueled graphite elements specified herein shall be made from Great Lakes 1008 (purified) graphite flour. The flour shall conform to WANL PDS 30046, except that Sections 5 and 6 of PDS 30046 are excluded. A statement showing the particle size distribution of the flour shall be submitted to WANL for information. The elements shall be produced by extruding, curing, baking, and graphitizing in accordance with a process specification to be submitted by Y-12 for WANL approval.

5. DENSITY

For information purposes, one of each ten elements shall be selected at random for density tests. The density shall be measured according to a procedure which shall be submitted to WANL for approval.

6. INSPECTION

6.1 Elements for flexural testing at WANL: One of each twenty elements produced shall be selected at random and shipped to WANL. A listing of the serial numbers of the elements shipped in compliance with this section shall be sent to WANL at the time of shipment.

6.2 Radiography: Each element shall be radiographed in conformance with the requirements on the applicable drawing. Any alternate procedure proposed for meeting the requirements of this section shall be submitted to WANL for approval before shipment is begun. All elements shall be rejected in which visual inspection and the radiographic tests reveal defects exceeding the limits as listed on the applicable drawing.

7. IDENTIFICATION

A system of individual element identification, implemented by a marking system as per applicable drawing, shall be applied so that the test results from the procedures of Sections 5, 6.1, and 6.2 can be identified in all cases to the exact element(s). For any markings not specified or not in conformance with the applicable drawing, a request shall be submitted to WANL for approval.

8. TEST REPORTS

The manufacturer shall furnish five copies of the test reports containing quantitative results of the tests required by Sections 5 and 6.2. The test data shall be keyed through the marking system (Section 7) to the individual elements in all cases.

9. SHIPMENT

9.1 Packing: All elements shall be packed in a manner to prevent damage during shipment. The packaging procedure shall be submitted to WANL for approval.

9.2 Marking: All packages shall be plainly marked to show:

Oak Ridge Extruded Unfueled Graphite Elements
Number of Elements Contained:
P D S 30061
Gross:
Tare:
Net Weight:

In addition, the elements shipped in compliance with Section 6.1 shall be marked:

For Flexural Testing

10. SOURCE SURVEILLANCE

10.1 Material covered by this specification is subject to source surveillance by a Westinghouse Quality Representative. This will include surveillance of the products, procedures, and facilities which relate to the manufacture and inspection of materials specified herein and in the accompanying documents.

Y-12 shall furnish necessary facilities and equipment to perform tests and supply data as required by applicable drawings and specifications.

10.2 Replacements may be required for any material furnished under this specification which, although accepted by the WANL inspector at the place of manufacture, is later found to contain previously undetected imperfections or is proved by tests and analyses to be not in accordance with this specification.

WESTINGHOUSE ASTRONUCLEAR LABORATORY

Westinghouse Electric Corporation

P. O. Box 10864, Pittsburgh 36, Pennsylvania

Quality Control Specification

No. WANL-QC-101 A

Effective Date

24 September 1962

Supersedes -

No. WANL-QC-101

Date 16 April 1962

QUALITY REQUIREMENTS FOR SUPPLIERS

Prepared By:

M. J. Regenda

Approved

F. W. Henning, Reliability

W. O. Anthony, Quality Control

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QUALITY ASSURANCE REQUIREMENTS FOR SUPPLIERS

1. General

1.1 Scope

This specification establishes the general Quality and Reliability requirements of the Westinghouse Astronuclear Laboratory, hereafter referred to as "Purchaser" or "WANL". It is applicable when called out on the drawing or purchase order contract.

1.2 Purpose

- a. It is emphasized that the supplier is solely responsible for the quality of his product and that any participation by the purchaser including receiving inspection, surveillance and source inspection is for the purpose of verifying conformance to contractual quality requirements and in no way relieves the supplier of his responsibility.
- b. In order to guide the supplier in fulfilling his quality responsibility, the following key subjects are outlined herein:
 1. The various methods used by the purchaser in evaluating supplier acceptability and performance. These include supplier survey, surveillance and supplier performance rating.
 2. The minimum general requirements for the supplier's Quality Control program including internal operating procedures and inspection activities.
 3. The specific forms used to implement the communications between the supplier and WANL Quality Control.

2. Supplier Evaluation

2.1 Supplier Quality Survey

- a. WANL representatives may conduct a survey of the supplier's plant prior to the award of a contract or anytime thereafter to determine the extent of compliance with this specification. All such surveys will be pre-arranged through WANL Purchasing Department communication with the supplier. This communication is to establish complete facts regarding the date, location, and nature of the survey, and to advise the supplier of the names of WANL personnel who will conduct the survey.
- b. As a minimum requirement, the supplier quality survey will include evaluation of the following areas:

1. Condition of manufacturing facilities and equipment.
 2. Quality control organization and procedures.
 3. Receiving, in-process and final inspection practices.
 4. Inspection and test equipment.
 5. Tool and gage control.
 6. Engineering organization.
 7. Quality control records.
 8. Past performance on similar jobs.
- c. The supplier shall furnish the survey team with copies of any organization charts, quality control manuals, machine tool lists, inspection and test equipment lists, or general brochures as desired by the team.

2.2 Quality Surveillance of Supplier

- a. The purchaser may review the supplier's procedures, practices, processes, products and inspection records at any time during the manufacturing cycle to determine the extent of the compliance with a given purchase order and with the provisions of this specification.
- b. The purchaser may accomplish supplier surveillance by any or all of the following methods:
1. Review written quality control policies and procedures to determine their acceptability.
 2. Review operating practices to determine effectiveness in implementing the above prescribed policies and practices.
 3. Review inspection records to determine level of product quality and identify significant quality trends.
 4. Perform or witness sufficient inspection and tests in supplier's plant to determine effectiveness in controlling product quality and in meeting the quality requirements of the purchase order.
 5. Maintain records on the supplier's product in service to monitor the performance and failure history which reflects product quality.
 6. Perform sufficient receiving inspection including re-inspection to establish the quality level.

2.3 Quality Performance Rating of Supplier

- a. The purchaser will maintain a supplier quality performance rating system for the purpose of establishing a list of qualified sources

for each of the various major products or processes.

- b. The individual supplier's quality rating shall be based on the following factors:
 - 1. Actual product performance as demonstrated by the purchaser's receiving inspection, service test records and other quality control records.
 - 2. Information obtained through supplier surveillance.
 - 3. Background information obtained from supplier surveys.

3. Supplier's Quality Control Program

3.1 Organization - The supplier shall maintain an effective quality program to satisfy the contract requirements.

- a. The responsibility for this function within the organization shall be clearly defined.
- b. The supplier's quality program shall ensure effective control of quality beginning with design considerations where applicable, through material procurement from lower tier suppliers, manufacturing and packaging processes.
- c. A published quality control policy and procedures manual is desirable. In lieu of a formal manual, an acceptable procedure must be agreed upon by WANL prior to use on WANL contracts.

3.2 Design Control

3.2.1 Supplier Cognizance

- a. The supplier shall assure that all drawings and manufacturing information clearly define standards of quality that are consistent with the purchase order requirements.
- b. A system shall be in effect for the processing and control of drawing and specification changes which assures expeditious dissemination of such information throughout the manufacturing organization and provides for immediate removal of obsolete information from circulation and use. Records of all such changes shall be maintained and made available to the purchaser upon request.
- c. The supplier shall assure that all the latest applicable drawings, specifications, and change notices are available at the time and place of inspection.

- d. Drawings originated by the supplier shall be reviewed by WANL Engineering and Quality Control personnel to insure that the provisions of paragraph (a) are met and that the design otherwise conforms to the requirements of the purchase order.

3.2.2 WANL Cognizance - Paragraphs 3.2.1 b and c shall be applicable.

3.3 Material Control

- a. The supplier shall exercise effective quality control over all outside purchased material for use on WANL orders to assure that such material meets all quality requirements. This control shall consist of either inspection upon receipt, inspection at source of manufacture, or verification of certified inspection and test data furnished by the manufacturer.
- b. Records of purchased material inspection shall be maintained and made available to the purchaser on request.
- c. Government source inspection does not relieve the supplier of his responsibility for verification of quality of outside purchased material.
- d. WANL supplied material must be cleared by a "Quality Control Material Release" Form WANL 1034 (Appen. I) and authorized by a "Procurement Advisory Release" before the supplier can process such material. This release does not relieve the supplier of his responsibility to verify that the material is as required dimensionally.

3.4 Tool, Gage and Test Equipment Control

- a. The supplier shall provide, as required, all of the precision measuring instruments and test equipment necessary to properly verify that the material supplied to the purchaser meets all requirements. Such items may include those provided by the purchaser for the supplier's use on a particular job.
- b. The supplier shall provide adequate physical control and safeguarding of precision tools, gages and test equipment to prevent misuse and damage when not in use.
- c. The supplier shall establish and maintain a schedule for periodically checking against master standards and calibrating all precision tools, gages and test equipment applicable to work performed for the purchaser, including any that may have been furnished by the purchaser for supplier's use.

If the supplier doesnot maintain his own master standards, then such checking and calibration shall be performed by a government or WANL approved laboratory. The scheduling procedure shall include the maintenance of individual records, marking of the tools and equipment with a tag or other suitable means by which it is shown when calibration was performed and the next date for calibration.

- d. Master standards maintained by the supplier shall be periodically certified for accuracy and evidence of such certification shall be made available to the purchaser on request.
- e. New and reworked tools, gages and test equipment shall be calibrated before being released for production use.
- f. Those practices and procedures relating to tools and gages as outlined in paragraphs 3.4.a, 3.4.b and 3.4.e shall also apply to production jigs and fixtures.

3.5 Manufacturing Control

3.5.1 Inspection Instructions

The supplier shall provide his inspectors with specific written instructions clearly detailing what characteristics to inspect, what standards of acceptance to use, how many units to inspect, what data to record, and what action to take as a result of inspection findings. Statistical sampling may be specified with prior approval by WANL.

3.5.2 In-Process Inspection

The supplier shall determine in advance of beginning production, those points throughout the process of manufacture where inspection or tests are required to assure adequate control of quality and accordingly establish and maintain such in-process inspection operations as are necessary.

3.5.3 Final Inspection

The supplier shall perform sufficient final inspection and testing to assure compliance of the finished product with the purchase order requirements.

3.5.4 Inspection and Test Records

The supplier shall maintain adequate records of all inspections and tests applicable to the purchaser's material.

The records shall contain positive evidence that each characteristic of the WANL specifications and drawings referenced in the purchase order has been inspected. Listing of actual measurement values for individual characteristics is a desirable feature in records and shall be mandatory when specifically called for in the purchase order requirements. All inspection records including ultrasonic traces, radiographs, dimensional check lists, certifications, etc., shall be made available to the purchaser on request at any time during the manufacturing cycle or after its completion as evidence of continued control of quality throughout the process and shall be retained by the supplier for three years after shipment of the material to the purchaser. Earlier disposal of records requires prior written approval of WANL.

3.5.5 Process Control Records

Wherever statistical process controls are used by the supplier, all resultant control charts, frequency histograms, sampling data cards, etc. shall be considered as inspection records and the provisions outlined in paragraph 3.5.4 shall apply to them.

3.5.6 Material Identification

3.5.6.1 Incoming Material

All material including raw material, shall be identified by a unique serial, batch, or lot number to correlate with specific inspection records. Additional identification may be called for on the drawing and /or purchase order. When part serial numbers are required, the supplier will identify each identical part utilizing a numbering system starting with one (1) and running consecutively. In addition, the serial number shall be preceded by the supplier's code letters. The supplier's code shall be two (2) letters assigned by WANL and called out on the purchase order. Example: A part manufactured by Jones Manufacturing Company, Code (JM) would be identified by:

(Part No.) - 654J839 H02A

(Serial No.) - JM 1 thru 999,999

A different part manufactured by the same company would be:

(Part No.) - 684J421 H012

(Serial No.) - JM 1 thru 999,999

Specific care must be taken to prevent duplication of serial numbers. The supplier shall maintain a list of serial numbers. Serial numbers on follow-up orders for the same part shall run consecutively from the last serial number used in the previous order. Identification methods shall be as defined by WANL Process Specification - WANL 294517 drawing or purchase order.

3.5.6.2 Inspection Status of Material

The inspection status of material (accepted, rejected, held for disposition) shall be evident at all times throughout the manufacturing cycle and shall be indicated by stamps, tags or other suitable markings applied to or accompanying the material. This also includes evidence of performance of special processes as are outlined in paragraph 3.5.7.

3.5.6.3 Evidence of Final Inspection

Final inspection and acceptance by the supplier shall be indicated by inspection stamps applied directly to the material in such a manner as to be readily identified but not detrimental to the quality or appearance of the item. If direct use of the stamp is inadvisable due to size or quantity of parts or if its use would damage or mutilate the part, then the stamp shall be applied to the package, tab or label.

3.5.7 Special Processes

Certain special processes are defined by drawing specification or purchase order (examples: welding, plating, x-ray, magnetic particle and dye penetrant testing) may require purchaser and/or Government approval and certification. Approval shall be obtained by submission of WANL "Approval Request", Form WANL 1008-A (Appendix II).

In addition, some processes such as welding and x-ray inspection may require certification of the operators and equipment to the applicable specification in order to fulfill the terms of the purchase order. Evidence of such certifications shall be made available to the purchaser on request.

3.6 Discrepant Material Control

- a. The supplier's inspection procedures shall include adequate measures for positive segregation of discrepant incoming, in-process and finished material from acceptable material to assure its removal from the manufacturing cycle. Such measures shall clearly identify the material as being discrepant by the use of stamps, tags or other suitable markings and provide for physical separation from acceptable material.
- b. The supplier shall have an established procedure for review and analysis of questionable material by higher authority to determine its disposition.
- c. Any departure from the contract requirements relating to plans, specifications and drawings must be considered in terms of a "Variation Request". The supplier is required to obtain specific WANL disposition on any variation prior to the continuation of any work on such material. Failure to do so is at the supplier's own risk. The "Variation Request", Form WANL 1005-A (Appendix III) shall be completed and submitted for approval in accordance to paragraph 6.4.
- d. Variation Request, approved or disapproved will be transmitted to the supplier by a formal contract supplement, the Procurement Advisory Release (PAR), (Appendix V).
- e. If the Variation Request is not approved by the purchaser, the material must be scrapped or reworked at no expense to WANL, to meet the specifications. All repair procedures shall be approved by WANL.

3.7 Handling, Packaging and Shipping Control

- a. The supplier shall plan for, provide and maintain throughout the manufacturing cycle such measures as are necessary to adequately safeguard incoming, in-process and finished material from damage. These measures may include protective packaging or wrapping and/or special handling instructions as called out in the purchase order or specification.

- b. The supplier shall plan for and provide adequate packaging of the finished product to prevent damage during transit to the purchaser. When necessary, special handling and storage instructions shall be provided on the exterior of the package.
- c. The supplier shall provide adequate controls in his shipping department to assure inclusion of all applicable documents with shipments to the purchaser.

4. WANL Inspection at Vendor's Plant

- a. The supplier shall notify the cognizant WANL Quality Representative 48 hours in advance of final inspection or any "hold point" stipulated in the purchase order. WANL may participate in all or various parts of the final inspection and shall have access to all pertinent inspection data or records pertaining to the contract.
- b. WANL participation in in-process or final inspection at source in no way relieves the supplier of his inspection responsibilities in accordance with contract requirements.

5. Government Furnished Equipment

5.1 Condition and Useability

- a. When supplier receives Government Furnished Equipment from WANL in accordance to purchase order, the following shall be accomplished:
 - 1. Inspect to extent practical for transit damage, completeness, proper type, size or grade for intended end use.
 - 2. Verify equipment accompanied by WANL Quality Control Material Release.
 - 3. Unless otherwise specified, supplier shall perform functional testing prior to further processing or installation to determine satisfactory operation.

5.2 Handling and Storage

Supplier shall provide protection, periodic inspections and controls to ensure that quality is maintained, storage conditions are adequate, and damage or deterioration does not occur in handling or storage.

5.3 Defective GFP

If defective government furnished material is received, supplier shall immediately notify purchaser and request disposition.

6. Implementation

6.1 General

- a. The foregoing sections of this specification have outlined the responsibilities of the supplier and WANL in fulfilling the requirements of a purchase order.
- b. This section shall define the procedures and forms for implementing the quality communications between the supplier and WANL with regard to WANL supplied material, supplier approvals, discrepant material and supplier quality certification.

6.2 Quality Control Material Release for WANL Supplier Material (Appendix I)

6.2.1 Use

This form shall accompany all material supplied by WANL. Without this release, the supplier assumes all risks involved in processing uncertified material.

6.2.2 Instructions for Completing Form WANL 1034

The form is self-explanatory.

6.3 Approval Request (Appendix II)

6.3.1 Use

This form shall accompany all quality submittals by the supplier required by purchase order, product specifications, drawings and this specification for approval to process and inspect material. Examples include process outlines, process specifications, sampling plans, inspection procedures (such as radiography, ultrasonic testing, eddy current testing) and repair/rework procedures.

6.3.2 Instructions for Completing AR Form WANL 1008-A

- (1) AR Number - Preprinted on form by WANL.
- (2) Previous AR Number - List previous submitted AR numbers referring to same subject.
- (3) Supplier Address - Name plus city and state.
- (4) Purchase Order No. - WANL purchase order number with supplier.
- (5) Government Contract - WANL Government contract (Not to be filled in by supplier unless shown on purchase order.)
- (6) Purpose - Specify reason for Approval Request.
- (7) Requirement - Show applicable purchase order requirement specifying the need for this request. Include section or paragraph numbers such as: Spec. WANL-QC-101, Rev. A Section 3.5.7.

- (8) Describe Request - Specify in detail the subject matter for which approval is being requested.
- (9) Supplier's Signature, Title and Date - Person authorized to sign request.
- (10) WANL Disposition and Comments - Self-explanatory.
- (11) Final Disposition - Self-explanatory except "Conditionally Approved" can be used only if comments specifying the restrictive conditions are included.
- (12) Planning Part No. - Not to be completed by supplier.

6.3.3 Method of Submittal and Return

- a. The supplier shall make sufficient copies of the AR (as submitted) for his own records.
- b. The AR shall be submitted to WANL Quality Control with three (3) copies of attachments.
- c. The supplier will be notified of the disposition through a Purchasing Department communication.

6.4 Variation Request (Appendix III)

6.4.1 Use

- a. This form shall be used for requesting approval of material which does not conform to purchase order specifications and drawings. Normally, material known to be discrepant shall not be submitted to WANL. However, under special circumstances, variant material and records may be presented to WANL for consideration.
- b. In extraordinary circumstances, if the supplier is convinced prior to production that his process is not capable of meeting drawing or specification requirements he may submit a waiver type of Variation Request with recommendations for tolerance relaxations. This request must have exceptionally sound justification before it will be considered by WANL.

6.4.2 Instructions for Completing VR Form WANL 1005-A

- (1) Deviation or Waiver - Check one. A deviation applies to known discrepant material. A waiver refers to parts on which discrepancies are expected to occur.
- (2) Supplier's Serial No. - Assigned by supplier, consists of supplier's two letter symbol, furnished by purchaser, followed by D (Deviation) or W (Waiver) and a number.

- The numbers shall be consecutive starting with One (1) for each different purchase order. Example: Jones Manufacturing - Code Symbol (JM), Serial No. JM-D1.
- (3) WANL Reference No. - A consecutive number which will be assigned by WANL Q. C. upon receipt of Variation Request from supplier.
 - (4) Department or Supplier Initiating Request - Supplier's name & address, or WANL Department Name.
 - (5) Date - Self explanatory.
 - (6) Part No. - Complete in detail.
 - (7) Government Contract - Not to be filled in by supplier, unless shown on purchase order. This refers to WANL contract with its customer.
 - (8) Dwg. Sketch or Data Attached - Self explanatory.
 - (9) Part Name - Include stage of fabrication for parts made such as "final machined", "as welded", etc.
 - (10) Quantity on Order - Self explanatory.
 - (11) Quantity and/or serial number affected - List serial numbers of all parts covered by this VR. If parts are not serialized indicate quantity and method of identification such as lot number. If serial numbers are too extensive, list quantity and note "See below".
 - (12) Purchase/Shop Order - Line through "purchase" or "shop" whichever is not applicable and list order number.
 - (13) Requirement - Be specific in stating the requirement and applicable contractual document. If more than one requirement is covered, itemize, eg. A,B,C, and then list applicable drawing, specification, paragraph and revision, pertaining to each requirement.
 - (14) Statement of Condition - Describe actual condition of parts, correlating the serial numbers of parts in question with the itemized requirement in (13). When VR is for a waiver (See (1) above), reasons for justification of waiver shall be fully explained in this block and/or attachments. Also in this block, show all VR's properly numbered by their prefix (D) or (W) that pertains to the variation or waiver.
 - (15) Supplier Recommended Action - Be specific as to action (use additional plain sheets if necessary).

- (16) Corrective Action - Same as (15).
- (17) Quality Control and Sales Representative Signature - Cognizant Quality Control Supervisor responsible for quality of the parts and Sales Representative responsible for the administration of the purchase order.
- (18) Date - Self-explanatory.
- (19) WANL Quality Control Representative - Will sign when possible. For internal use, this shall be the WANL Issuing Inspector or Quality Control Supervisor.
- (20) Date - Self-explanatory.
- (21) WANL Disposition - Self explanatory with comments as necessary.
- (22) Price Consideration - Shall be completed by supplier.
- (23) Planning Part No. - Not to be completed by supplier.

6.4.3 Method of Submittal and Return

- a. The supplier shall make sufficient copies of the VR (as submitted) for his own records.
- b. The VR master shall be submitted to WANL.
- c. After WANL disposition is completed, the original mat shall be forwarded with a Procurement Advisory Release to the supplier.

6.5 Supplier's Quality Certificate and Shipping Release (Appendix IV)

6.5.1 Use

The Supplier Quality Certificate and Shipping Release summarizing all processing and quality determinations performed shall be submitted with each shipment of material that requires WANL source inspection or specifically called for on the purchase order. Actual test results and records shall be attached as required by the purchase order, drawing or specification.

6.5.2 Instructions for Completing Form WANL 1036

The form is self-explanatory in its method of completion except that supplier's serial number shall be the supplier's code symbol and a consecutive number starting with one (1) for each different purchase order.

6.5.3 Submittal

The supplier shall complete the certificate in triplicate. Two copies of all required data and records shall also be provided.

The assembled package shall then be presented to the WANL Quality Control Field Representative prior to shipment. Upon approval by the WANL representative, as denoted by his signature on the certificate, the supplier shall retain one copy for his records and enclose the remaining two copies of certificates and supporting data with the shipment of material. If material that requires WANL source inspection is shipped without WANL source inspection, the Authority for Shipment block shall be completed.

6.6 Procurement Advisory Release (Appendix V)

WANL Purchasing Department Document for transmitting and authorizing any changes to the original purchase order. The form is self-explanatory.

QUALITY CONTROL MATERIAL RELEASE

WESTINGHOUSE ASTRONUCLEAR LABORATORY

Westinghouse Electric Corporation

P. O. Box 10864 Pittsburgh 36, Pennsylvania

Release No. _____ P. A. R. No. _____

Material Purchased on P. O. No.	Material Consigned to P. O. No.	Qty to be Supplied	Part No. Consisting of; Dwg. No. <u>Item/Grp/Assy</u> <u>Rev.</u>
		Qty this shipment	
Supplier & Address	Supplier & Address	Qty to be Shipped	Part Name
Serial Nos.			Planning Part No.

The above material, manufactured in accordance with Drawing _____
Revision _____ and Specification _____ Revision _____ is hereby
released by Quality Control as acceptable for further processing with exceptions noted below.
This release does not relieve the subcontractor of his responsibility to verify that the material
furnished is as required dimensionally.

Signature

Title

Date

Contingencies:

APPROVAL REQUEST

Ⓜ WESTINGHOUSE ASTRONUCLEAR LABORATORY
 Westinghouse Electric Corporation
 P. O. Box 10864 Pittsburgh 36, Pa.

AR No. (1)Previous AR No. (2)

Supplier and Address (3)	Purchase Order No. (4)
	Gov't Contract (If applicable) (5)
Purpose (6)	Requirements (7)

Describe Request in Detail: Include Title, Number and Revision of all attachments.

(8)

Supplier's Authorized Representative (9) Title Date		
WANL Disposition (10)		Comments
Design Engineering Title Date		
Reliability		
Quality Control		
Other		
<u>Final Disposition</u> (11) ☐ Approved ☐ Conditionally Approved ☐ Disapproved		Planning Part No. (12)

(W)

VARIATION REQUEST

(Appendix III)

WESTINGHOUSE ASTRONUCLEAR LABORATORY
Westinghouse Electric Corporation
P. O. Box 10864 Pittsburgh 36, Pa.

Supplier's Serial No. (2) (Code & No.)

☐ Deviation ☐ Waiver (1)

WANL Reference No. (3)

Dept./Supplier initiating Req.-Address (4)		Date (5)	Part No. Consisting of: <u>Dwg. No.</u> <u>Item/Group/Ass'y</u> <u>Revision</u> (6)	
Gov't Contract (when applicable) (7)		Dwg. Sketch ☐ yes or Data ☐ no attached (8)		Part Name (9)
Quantity on Order (10)	Quantity/Serial Nos. Affected (11)		Purchase/Shop Order (12)	
Requirements per P.O./Drawings/Specification (13)		Statement of Condition (14)		
Supplier Recommended Disposition and Justification ☐ Repair ☐ Rework ☐ Other (Explain in Detail) (15)				
Corrective Action Taken by Supplier to Prevent Recurrence (16)				
Supplier-Q.C. Supv. and Sales Rep. Signature (17)		Date (18)	WANL Q.C. Rep. Signature (19) Date (20)	
DISPOSITION (21)		Comments		
Quality Control	Date			
Engineering	Date			
Reliability	Date			
Final Consideration on Purchase Order ☐ Yes ☐ No (22)		Planning Part No. (23)		

SUPPLIER'S QUALITY CERTIFICATE & SHIPPING RELEASE

W

WESTINGHOUSE ASTRONUCLEAR LABORATORY
Westinghouse Electric Corporation
P. O. Box 10864 Pittsburgh 36, Pa.

Supplier's Serial No. _____

Supplier and Address		Date	Part No. Consisting of: <u>Dwg. No.</u> <u>Item/Group/Ass'y</u> <u>Revision</u>	
Gov't Contract (when applicable)		Spec. No. and Rev.	Part Name and Description	
Quantity on Order	Quantity this Shipment	Balance on Order	Purchase Order No.	
Serial Nos.		Planning Part No.	Shipment and No. ____ Partial ____ Final	

Checks in appropriate blocks identify all required inspections, tests and processing verified or performed by the Supplier (or Supplier's Sub-Contractor.) Two (2) copies of test results, records, certifications, etc. required by purchase order and specifications are attached as indicated.

Requirements	Data attached	Applicable VR Nos. and Remarks
☐ Raw Material Tests (Specify type) ☐ Receipt of WANL Supplied Mat'l Q. C. Rel. ☐ Heat Treat ☐ Plating (Specify type) ☐ Weld Certification ☐ Dimensional Inspections ☐ Radiographic Inspections ☐ Ultrasonic Inspections ☐ Dye Penetrant Inspection (Specify type) ☐ Pressure or Leak Tests ☐ Functional Tests ☐ Others (Specify)		

Certification: The above material meets the requirements of the drawings and specifications except for approved variation requests. All processing, inspections and tests have been performed per approved procedures.

Supplier's Signature Title Date

WANL QC Field Rep. Signature or Authority for Shipment, and Date:	Comments
WANL Receiving Inspection & Date	Disposition and Comments

PROCUREMENT ADVISORY RELEASE
 FORM 31990 A

DOUBLE LINE BOXES TO BE COMPLETED BY THE PURCHASING DEPT.

FROM ASTRONUCLEAR LABORATORY P O BOX 10864 PITTSBURGH 36, PA.	P. A. R. NO.	DATE OF RELEASE	THIS RELEASE APPLIES TO:	
			PURCHASE ORDER NO.	DATED
TO	BUYER		NO.	
	SUBJECT		PROJECT NO.	

ATTENTION: _____

IF INFORMATION CONTAINED HEREIN DOES INVOLVE A CHANGE IN PRICE, DELIVERY OR TERMS AND CONDITIONS, YOU ARE NOT TO PROCEED WITH THE WORK, BUT IMMEDIATELY NOTIFY THE BUYER, PURCHASING DEPARTMENT AT THE ABOVE ADDRESS."

ATTACHMENTS:

WRITTEN BY	DATE	DEPT.	APPROVED BY	DATE	DEPT.	PAGE
						OF

 CONFIRMING: WIRE ☐ VERBAL ☐ TO _____ ON _____

PLEASE ACKNOWLEDGE RECEIPT AND ACCEPTANCE OF THIS RELEASE BY COMPLETELY FILLING IN AND RETURNING ONE COPY TO WESTINGHOUSE ELECTRIC CORPORATION AT THE ABOVE ADDRESS, WITHIN 15 DAYS FROM DATE OF RELEASE
 MARK FOR ATTENTION OF:

AUTHORIZED BY: _____

ACKNOWLEDGMENT
 (RETURN IMMEDIATELY)

ACKNOWLEDGED AND ACCEPTED BY	
SIGNED BY SUPPLIER	DATE

Westinghouse Electric Corporation
Astronuclear Laboratory
P. O. Box 10864
Pittsburgh 36, Pennsylvania

PROCESS SPECIFICATION WANL 294506

September 25, 1962

SUPPLEMENTARY MANUFACTURING INFORMATION

These standards when called for on a drawing by process number shall be the basic tolerance specification for the drawing. All parts must be manufactured and inspected to these standards unless otherwise specified on the drawing. Specific drawing information always takes precedence over these standards.

1. General

- A. Detail Drawing: A detail drawing defines a single part or tabulation of parts. The characteristics and requirements shown on the detail drawing are a requirement of the final assembly (unless noted to the contrary on the assembly or weldment drawing).
- B. Assembly Drawing: An assembly drawing depicts two or more detail parts and/or sub-assemblies not permanently fastened together. The assembly drawing shows the relationship of these parts when fitted together and specifies all requirements not shown in the details.
- C. Weldment Drawing: A weldment drawing depicts two or more detail parts which are fastened together by permanent methods. The weldment drawing shows only those dimensions and other information required to properly relate the detail parts and specifies all requirements not shown in the details.
- D. Decimal dimensions shall be corrected to $68^{\circ}\text{F} \pm 2^{\circ}$. Corrections must be made to account for differential expansion of measuring instruments with respect to parts being measured.
- E. Where a tolerance is proportional to the length of a surface it shall apply to the entire surface in the plane regardless of surface interruptions.

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F. Surface finish symbol $\sqrt{32}$ $\sqrt{63}$, etc., is used to designate the degree of roughness of the surface to which it is applied. The numbers 32, 63, etc., refer to the maximum allowable roughness in microinches (arithmetical average to conform with MIL-STD-10).

G. There are no surface roughness requirements on edges of sheet and strip with a nominal thickness of .125 and under and on the ends of tube with a nominal wall thickness of .125 and under.

H. Threading:

1. Internal threads.

- (a) When bottoming threads are indicated, the threads shall be full within two and one-half ($2 - 1/2$) threads of the bottom.
- (b) The axis of the pitch diameter shall be perpendicular to the reference surface within .002 per inch of working length of thread.
- (c) Countersink all internal threaded holes $110^\circ \pm 2^\circ$ included angle to the minimum major diameter + .030 - .000 and concentric within .020 TIR.

2. External threads.

- (a) Dimensions showing length of thread shall be minimum full thread.
- (b) The concentricity of the thread P. D. in relation to the shank shall be within .002 TIR.
- (c) Run out for straightness of shank shall not exceed .0005 TIR per inch of length.

3. Thread Form

Threads shall be in accordance with MIL-STD-9.

J. Terminology:

- 1. Axis (True axis) - A straight line, real or imaginary, passing through a body that actually or theoretically revolves about it, or around which parts are symmetrically arranged. See reference axis.
- 2. Basic, True position, Basic location - The exact theoretical location.
Where a dimension is not stipulated as basic, and nominal dimensions are provided, then the nominal dimensions shall be used to determine the theoretical location.

3. Lines nominally shown at right angles to a surface and not otherwise dimensioned shall be considered to be perpendicular to that surface.
4. Reference Axis - A theoretical axis to which measurements are referred.
5. Concentricity - A condition where the center of one symmetrical part or assembly coincides with the center of another.
6. Eccentricity - A condition where the center of one cylindrical surface is offset from the center of another.
7. Total indicator reading (TIR) - Refers to the total movement of a pointer on a dial indicator that shows the amount of surface deviation, when a piece is rotated 360 degrees from absolute concentricity, circularity, parallelism, squareness, and straightness. If there is perfect circularity, and eccentricity is present, the TIR will be double the eccentricity. For plane surfaces, TIR refers to the total movement of a pointer on a dial indicator that shows the amount of surface deviation when a piece is traversed through its extreme limits.
8. Break Edges - Describes the removal of the sharp edge formed by the meeting of two surfaces.
9. Datum Dimension - An untoleranced but theoretically exact dimension locating a point, line, or plane, where the feature of a part must be within certain specified limits. It may also be the exact dimension of a feature whose location may vary within specified limits.
10. Datum Elements - Datum surfaces, datum planes, datum diameters, etc., are features of a part that is assumed to be exact for purposes of computation or reference, while another feature or other features of the part may vary with respect to the datum.
11. Datum Point, Plane or Line - Apply to a point, plane, or line from which working dimensions and operations are based.
12. Dimension, Reference - A dimension without tolerance used for informational purpose only. It is not a working dimension, does not govern machining operations in any way, and is not subject to inspection. Reference dimensions shall be indicated on drawings by writing the abbreviations "REF" directly following or under the dimension.

13. Rotatable - Capable of being rotated about its own axis for the purpose of manufacture or inspection.
14. Squareness - The perpendicularity between the reference surface or reference axis and the nominal plane under consideration.
15. Taper - A difference in diameter, width, or thickness per unit of length measured at right angles to the length.

II. Standard Tolerances

A. The following are geometric and dimensional tolerances for surfaces.

1. Geometric Tolerances (See Appendix I)

<u>Symbol</u>	<u>Geometry</u>	<u>Tolerance</u>
Flat and Straight	See Note 1
Perpendicularity	See Note 2
Parallelism	See Note 3
Angularity	.005 in.
True Position	.010 Dia.
Concentricity	.006 TIR
Roundness	.010 TIR
Symmetry	.006 in.

Notes:

1 Flat and Straight Tolerances

(a) Straightness

Surfaces must be straight within .0005 per inch

(b) Flatness

Machined faces shall be flat within .0005 per inch

2. Perpendicularity Tolerances

(a) For Non-rotatable parts.

<u>Length</u>	<u>Tolerance</u>
0 to 3	.0005 per inch
over 3 to 10	.002 total length
over 10 to 20	.004 total length
over 20	.010 total length

(b) For rotatable parts

<u>Diameter</u>	<u>Tolerance</u>
0 to 3	.0005 TIR per inch of dia.
over 3 to 10	.002 TIR at the max. dia.
over 10 to 20	.004 TIR at the max. dia.
over 20	.010 TIR at the max. dia.

3. Parallelism Tolerances

Machined Surfaces

<u>Length</u>	<u>Tolerance</u>
0 to 3	.0015 per inch of length
over 3 to 10	.002 total
over 10 to 20	.004 total
over 20	.010 total

2. Dimensional Tolerances

(a) For 2 place decimals: $\begin{smallmatrix} + \\ - \end{smallmatrix} .02$

For 3 place decimals: $\begin{smallmatrix} + \\ - \end{smallmatrix} .005$

For 4 place decimals: $\begin{smallmatrix} + \\ - \end{smallmatrix} .0005$

(b) Surface roughness - the surface finish ($\sqrt{\text{ }}$) shall be 125 microinches - AA - (arithmetic average) unless otherwise specified on the drawing.

(c) Formed Parts - thickness of formed parts shall not be less than 85% of the minimum thickness of the sheet specified on the drawing.

(d) Chamfers - $\begin{smallmatrix} + \\ - \end{smallmatrix} 2^{\circ}$

(e) Fillets

(1) Ductile Material (greater than 10% elongation at room temperature).

.010 - .020 approximate radius.

(2) Brittle Material (less than 10% elongation at room temperature).

.030 - .040 approximate radius.

(g) External Corners

(1) Ductile Material

Break sharp corners and edges to a chamfer or approximate radius of .005 - .015.

(2) Brittle Material

Break sharp corners and edges to a chamfer or approximate radius of .015 - .030.

	<p>FLATNESS AND STRAIGHTNESS</p> <p>FLATNESS</p>	<p>The tolerance governing the flatness of a plane surface is the distance between two parallel planes between which all bearing points of the relevant plane surface must lie.</p>
<p>METHOD OF SPECIFYING FLATNESS ON DRAWINGS</p>	<p>SYMBOL TOLERANCE</p> <p>THIS SURFACE SHALL BE FLAT</p> <p>WITHIN .002 INCH</p> <p>.002 TOLERANCE ZONE</p>	
	<p>STRAIGHTNESS</p>	<p>The tolerance governing the straightness of an axis or axial plane is the diameter or width of the tolerance zone within which the relevant axis or axial plane must lie.</p>
<p>METHOD OF SPECIFYING STRAIGHTNESS ON DRAWINGS</p>	<p>SYMBOL TOLERANCE</p> <p>THIS AXIS OR AXIAL PLANE SHALL BE STRAIGHT</p> <p>WITHIN .002 INCH</p> <p>.002</p> <p>NO ELEMENT OF THIS SURFACE SHALL DEVIATE MORE THAN .002 FROM A STRAIGHT LINE</p>	
	<p>ANGULARITY</p>	<p>The tolerance governing the angularity of surfaces, axes or axial planes in relation to each other is the width or diameter of the tolerance zone within which the relevant surface, axis, or axial plane must lie.</p>
<p>METHOD OF SPECIFYING ANGULARITY ON DRAWINGS</p>	<p>REF LETTER TOLERANCE</p> <p>SYMBOL</p> <p>THIS SURFACE SHALL BE AT THE SPECIFIED ANGLE</p> <p>WITHIN .001 INCH</p> <p>.001 TOLERANCE ZONE</p> <p>45°</p> <p>VERTEX AS ESTABLISHED BY LENGTH</p>

PERPENDICULARITY	The tolerance governing the perpendicularity of surfaces, axes, or axial planes in relation to each other is the width or diameter of the tolerance zone within which the relevant surface, axis or axial plane must lie.
PARALLELISM	The tolerance governing the parallelism of surfaces, axes or axial planes in relation to each other is the width or diameter of the tolerance zone within which the relevant surface, axis, or axial plane must lie.
CONCENTRICITY	The tolerance governing the concentricity of the axes is the radius of the tolerance zone within which the relevant axis must lie. The value placed in the symbol block, however, is the diameter of the tolerance zone and is followed by the abbreviation, TIR.
METHOD OF SPECIFYING CONCENTRICITY ON DRAWINGS	<p>SYMBOL REF. LETTER TOLERANCE</p> <p>WITHIN .002 TIR</p> <p>THIS AXIS SHALL BE CONCENTRIC TO THE SURFACE "A"</p> <p>.001 TOLERANCE</p> <p>.002 TOTAL INDICATOR READING OR TOLERANCE ZONE</p>
TRUE POSITION	The tolerance governing the true position of an axis is the radius of the tolerance zone within which the relevant axis must lie. The value placed in the symbol block, however, is the diameter of the tolerance zone followed by the abbreviation, DIA.
METHOD OF SPECIFYING TRUE POSITION ON DRAWINGS	<p>SYMBOL TOLERANCE ZONE</p> <p>WITHIN .002 DIA</p> <p>THE AXIS OF THIS HOLE SHALL BE IN ITS TRUE POSITION</p> <p>.002 DIA. OR TOLERANCE ZONE</p> <p>.001 TOLERANCE</p>
<p>AXIS OF HOLE</p> <p>TRUE POSITION OF AXIS</p> <p>CYLINDRICAL TOL ZONE</p> <p>HOLE DIA</p> <p>AXIS OF HOLE</p> <p>TRUE POSITION OF AXIS</p> <p>POSITIONAL VARIATION</p> <p>AXIS OF HOLE</p> <p>TRUE POSITION OF AXIS</p> <p>SQUARENESS VARIATION</p>

ROUNDNESS	The tolerance governing the roundness of a piece is the radial width of the tolerance zone within which the relevant circumference must lie.
<p>METHOD OF SPECIFYING ROUNDNESS ON DRAWINGS</p>	<p>THIS SURFACE SHALL BE ROUND WITHIN TIR</p>

SYMMETRY	The tolerance governing the symmetry axis is the distance between two parallel planes between which the axis must lie. The parallel planes being parallel to, and with equal distance about the axis.
<p>METHOD OF SPECIFYING SYMMETRY ON DRAWINGS</p>	<p>THIS AXIS SHALL BE SYMMETRICAL</p>	<p>THE MEDIAN PLANE OF THE SLOT, RFS, MUST LIE BETWEEN TWO PLANES .005 APART.</p>

4. SERIAL NUMBERS

A serial number consists of:

- A. Two letters (the supplier's code designation), plus
- B. A number beginning with one (1) and running consecutively 2, 3 999,999,etc.) for the quantity on order.

Serial numbers are assigned consecutively for each item or group number. If the part number does not contain an item or group number, serial numbers are to be assigned consecutively for each drawing number. Sequence of serial numbers for a given item shall not be interrupted because of revisions to drawings.

For example: A part manufactured by Jones Manufacturing Company, code JM, would be identified by:

654J839H01C = Part number

JM1 = Serial number

A different part manufactured by the same company would be

654J839H02C = Part number

JM1 = Serial number

If for an order of 50 parts, 25 parts were made to 654J839H02C and 25 were made to 654J839H02D, the serial numbers would run consecutively from 1 through 50.

4.1 The supplier's code letters shall be transmitted to the supplier by the WANL Purchasing Department.

4.1.1 Code letters AL and AC are reserved for Astronuclear Laboratory (Large Site) and Astrofuel Facility (Cheswick Site), respectively.

4.2 Serial numbers shall be assigned to lots when the drawing calls for lot identification.

4.3 Serial number sequence shall not be interrupted because of Purchase Order number changes. Serial numbers on follow-up orders for the same part shall run consecutively from the last serial number used in the previous order.

5. IDENTIFICATION LOCATION

A phantom outline of a location box is shown on the drawing. Part identification and serial number (when serialization specified on the drawing) shall be located within the box. The box is limited to 1/2 x 2 inches unless otherwise specified on the drawing.

6. PERMANENT MARKING METHODS

Permanent marking shall be raised or depressed so as not to affect the function or serviceability of the item and to insure maximum legibility and durability of the mark produced by the method and character height designated on the drawing. No permanent marking is permitted on the part except that defined on the drawing. Height and depth limits apply unless otherwise stated on the drawing.

6.1 INTEGRAL: Characters are produced by castings, forging and molding into or onto the part.

Mark depth - 0.005 min., - 0.010 max.
Mark height - 0.010 min., - 0.130 max.

6.2 METAL STAMP: Characters are produced by forcible displacement of material. The surface beneath that being stamped shall not be deformed, nor shall the characters be closer than 3/32" to an edge or fillet. The characters shall be applied before any surface treatment, such as anodizing or painting.

6.2.1 HAMMER: Characters are produced individually or in groups by a force applied mechanically or by hand.

Mark depth - 0.0001 min., - 0.010 max.

6.2.2 PRESS: Characters are produced individually or in groups by force applied with a steadily increasing controlled pressure or a controlled stroke.

Mark depth - 0.0001 min., - 0.010 max.

6.2.3 ROLL: Characters are produced by a rotating motion of either the part or the tool, or both, when in contact with each other under a controlled force at a setting which will give a marking depth within the limits specified.

Mark depth - 0.0005 min., - 0.010 max.

6.2.4 VIBRO PEEN: Characters are produced by a rapidly vibrating tool.

Mark depth - 0.001 min., - 0.010 max.

- 6.3 ENGRAVE: Characters are produced by a rotating cutter or grinder.

Mark depth - 0.0005 min., - 0.005 max.

- 6.4 ELECTRIC ARC SCRIBE: Characters are produced by the action of an electric arc between the surface and electrode which acts as the scribe. Current must be closely regulated to control the depth of marking as specified.

Mark depth - 0.0005 min., - 0.010 max.

- 6.5 SCRIBE: Characters are produced by a cutting or scratching action.

Mark depth - 0.001 min., - 0.006 max.

- 6.6 ACID ETCH: Characters are produced by the use of strong acids. Application of the acid may be by any means, but care shall be exercised to prevent acid or fumes from spreading to the surrounding area. The surface to be etched shall be clean, and after etching the acid shall be neutralized and corrosion preventive treatment applied.

Mark depth - 0.0001 min., - 0.004 max.

- 6.7 ELECTROLYTIC PROCESS: Characters are produced by the use of nearly neutral Ph electrolytic solutions to facilitate electrolysis which is confined to the area of the characters by a stencil.

- 6.7.1 ELECTROLYTIC ETCH: Characters are produced by removing material with an electrolytic process.

Mark depth - 0.00015 min., - 0.0011 max.

- 6.7.2 ELECTROLYTIC DEPOSIT: Characters are produced by adding material with an electrolytic process.

Mark height - 0.000 min., 0.003 max.

- 6.8 BLAST: Characters are produced by the impingement of an abrasive substance confined to the area of the characters by a stencil.

Mark depth - 0.0001 min., 0.003 max.

- 6.9 BRAND: Characters are produced by burning or displacing material with a heated tool.

Mark depth - 0.001 min., - 0.010 max.

- 6.10 CERAMIC: Characters are produced by a contrasting ceramic coating applied by any means prior to the initial firing.
- 6.11 DECALCOMANIA: Characters are applied by a wet transfer of a pigmented film bearing the characters from a suitable backing to the part. This film shall, when dry, adhere to the surface, resisting abrasion and remaining legible in its intended environment. If necessary, the decalcomania may be covered with a transparent moisture resistant coating.
- 6.12 INK: Characters are produced by applying an ink by any means which does not injure the surface. When this method is used for the final part identification number, the mark shall be protected with a transparent moisture resistant coating.

7. TEMPORARY MARKING METHODS

Temporary markings are permitted to insure identification during the process of manufacturing, acceptance inspection, assembly operations, ordinary handling and storage of parts. Such marking shall not be deleterious to the fabrication of parts and shall not adversely affect the function and serviceability of parts. Temporary markings may be retained on the finished part, provided they cannot be confused as part identification numbers.

- 7.1 INK: Characters are produced by applying an ink by any means which does not injure the surface.
- 7.2 DYE: Characters are produced by applying a dye by any means which does not injure the surface.
- 7.3 PAINT: Characters are produced by painting, with or without a stencil.
- 7.4 CRAYON: Characters are produced by writing or printing with a wax crayon.
- 7.5 TAG: A tag bearing identification is attached to the part.
- 7.6 BAND OR TAPE: A band or tape bearing identification is temporarily attached to the part.
- 7.7 CONTAINER: The container bears the identification of the part.

8. DRAWING LETTER REVISIONS

When parts have been modified to meet subsequent drawing letter revision requirements, the previous revision letter suffix shall be obliterated using the method allowed for part identification. When the revision

letter has been obliterated, the new revision letter shall be applied in the next space to the right using the method allowed for part identification. However, the serial number will remain unchanged.

9. CASTING OR FORGING NUMBERS

All casting or forging numbers shall be removed from finished parts, unless such numbers are prefixed with CSTG or FORG to identify them as Casting and Forging numbers. Such numbers not prefixed with CSTG or FORG shall be located in an area where machining operation will remove them.

10. VENDOR PRODUCED ITEMS

Identification of vendor produced parts shall be in accordance with WANL drawing requirements.

10.1 VENDOR DESIGNED PARTS: Vendor designed parts and assemblies shall be identified per this specification in accordance with the WANL specification control drawing requirements or when it is listed on the Purchase Order. Supplier designed components of assemblies shall be identified by the supplier's internal system.

10.2 STANDARD CATALOG PARTS: The vendor shall identify standard catalog parts in accordance with WANL drawing requirements. In general, these parts will be marked permanently and sufficiently to enable positive identification of the parts. When a permanent marking cannot be employed without impairing the function or serviceability of the part, identification shall be made by any of the temporary methods given in this specification.

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WANL-TME-406
WANL-TME-438

(Section Appears in
Both TME's)

WANL ELEMENT DATA PREPARATION REQUIREMENTS

I. Introduction

Presented herein is the description of punch-card format required for element data preparation by UCNC, Y-12. Specific requirements are described for WANL Phase I vibration test core and WANL NRX-A1 cold flow test core. This information includes only the card description and number of specific elements to be identified by loading and element size code as given in Table I. Sample cards shall be provided to UCNC, Y-12.

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Atomic Energy, 1954

2. WANL ELEMENT DATA PUNCH-CARD DESCRIPTION

<u>Column No. Inclusive</u>	<u>Description</u>
(First card) 1 - 8	Complete element serial number of which the first two digits define by code the fuel loading and number of channels respectively, then followed by a dash and five digits for the basic serial number. A typical WANL serial number is 99-12345. The first digit designates loading, i.e., (9). See Table I. The second digit, i.e., (9) designates element size, e.g., $9 + 10 = 19$ coolant channels.
10 - 14	Average measured loading, e.g., 417.5 mg/cc.
16	Element grade, e.g., the best being assigned a value of 1 and increasing with degree of imperfection.
18 - 21	*No. 1 channel diameter, e.g., 0955 for .0955 inches
23 - 26	No. 2 " "
28 - 31	No. 3 " "
33 - 36	No. 4 " "
38 - 41	No. 5 " "
43 - 46	No. 6 " "
48 - 51	No. 7 " "
53 - 56	No. 8 " "
58 - 61	No. 9 " "
63 - 66	No. 10 " "
(Second card) 1 - 8	Same complete element serial number as card No. 1
10 - 14	Reference data - CLDFW which would designate cold flow elements.

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Atomic Energy Commission

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[REDACTED] y Act - 1954

WANL-TME-406
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2A.

18 - 21	*No. 11 channel diam., e.g., .0965 for .0965 inches		
23 - 26	No. 12	"	"
28 - 31	No. 13	"	"
33 - 36	No. 14	"	"
38 - 41	No. 15	"	"
43 - 46	No. 16	"	"
48 - 51	No. 17	"	"
53 - 56	No. 18	"	"
58 - 61	No. 19	"	"

* See WANL-TME-306 for element channel and shim hole identification.

[REDACTED]
[REDACTED]
[REDACTED]

[REDACTED]
[REDACTED]
[REDACTED]

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3. VIBRATION I CARD DESCRIPTION

Transform Oak Ridge element data to the described WANL punch-card format as follows:

<u>Column No. Inclusive</u>	<u>Description</u>
(First card) 1 - 8	Replace "VI" of vibration I serial number with appropriate 2-digit code number. Identify on cards the indicated number of each loading and size given in Table I. Following these 2-digits should appear 2 zeros then the basic 4-digit vibration I serial number, e.g., 99001234
10 - 14	Nominal loading for the respective code given in Table I, e.g., 417.0 for loading code 9.
16	Element grade, e.g., 1
18 thru 66	blank
(Second card) 1 - 8	Same serial number as first card.
10 - 14	Data reference - VIB01. All vibration I elements are to have this identification.
18 thru 66	blank

Serialization of tie-rod elements will indicate a distinction between shimmed and unshimmed and should have the following respective serial number identification on the punch-cards, e.g.;

- 02001234 - shimmed tie-rod element
- 00001234 - unshimmed tie-rod element

Columns which are used to indicate average measured loading and channel diameter on fuel element cards are left blank on tie-rod element cards.

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4.

COLD FLOW PUNCH CARD DESCRIPTION

Transform Oak Ridge element data to the described WANL punch-card

format as follows:

<u>Column No. Inclusive</u>	<u>Description</u>
(First card) 1 - 8	Replace "CF" of cold flow serial number with the appropriate 2-digit code number. Identify on cards the indicated number of each loading and size given in Table I. Following these 2-digits should appear 2 zeros then the basic 4-digit cold-flow serial number, e.g., 99001234.
10 - 14	Nominal loading for the respective code given in Table I, e.g., 417.0 for loading code 9.
16	Element grade, e.g., 1
18 thru 66	Measured channel diameters 1 thru 10 as per WANL punch-card description.
(Second card) 1 - 8	Same serial number as first card.
10 - 14	Data reference - CLDFW. All cold flow elements are to have this identification.
18 thru 66	Measured channel diameters 11 thru 19 as per WANL punch-card description.

Serialization of tie-rod elements will indicate a distinction between shimmed and unshimmed and should have the following respective serial number identification on the punch-cards, e.g.;

02001234 - shimmed tie-rod element

00001234 - unshimmed tie-rod element

Columns which are used to indicate average measured loading and channel diameter on fuel element cards are left blank on tie-rod element cards.

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WANL-TME-406
WANL-TME-438

TABLE I

LOADING CODE AND ELEMENT REQUIREMENT FOR ONE
COMPLETE CORE ASSEMBLY ***

<u>Loading and Size Code</u>	<u>Nominal Loading</u>	<u>Required No. of Elements</u>
99*	417.0	1254
89	360.0	54
79	314.0	66
69	285.0	36
59	256.0	42
49	229.0	18
39	188.0	114
32**	188.0	42
Total tie rod elements - shimmed and unshimmed		289

* Standard fuel element having 19 coolant channels

** Partial element having 12 coolant channels

*** This tabulation is applicable to Vib-I, Vib-II and cold flow core assemblies.

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MANUFACTURING PROCESS SPECIFICATION FOR NRX-A COLD FLOW CORE

AND PLUGGED FLOW CORE

Mixing and Extrusion

Elements will be extruded from a mixture of graphite flour and Thermax using partially polymerized furfural alcohol as a binder. The usual mixture is 85% graphite flour, 15% Thermax with a binder content of 26% carbon weight. Elements are extruded directly into precision machined graphite setters in which they are cured and baked.

Graphite flour-Thermax mixture composition and binder content are all varied to control carbon density and radiographic quality. It is conceivable that the graphite mixture could contain 100% graphite flour, and the binder content vary from 22 to 32% of the carbon weight.

The graphite flour used will be Great Lakes grade 1008 purified or an equivalent which meets WANL PDS 30046 (excluding Sections 5 through 9 but which has a sieve analysis similar to that shown in Section 5).

Curing, Baking, and Graphitizing

Elements will be cured in air to a temperature of 250°C over a programmed cycle of 42 to 63 hours, baked in a nitrogen atmosphere to a temperature of 500°C over a programmed cycle of 5 to 20 hours, and graphitized under lightly flowing helium to an optically observed temperature of at least 2425°C.

Machining and Inspection

Element flats will be broached or milled at UCNC, Y-12 option. All element gas flow passages will be reamed. Element ends will be counterbored or turned using conventional machining techniques. Inspection will be accomplished as outlined in the Process Inspection Outline WANL Approval Request No. 0769. Radiographic inspection will be accomplished as outlined in UCNC, Y-12 Procedure R-3, Revision B.

Packing and Shipping

Elements will be enclosed in a length of 2" tubular polyethylene protective wrapping material to be supplied by WANL. Each tube end will be sealed. Elements will be packed as outlined on WANL Approval Request No. 0765 and shipped in accordance with WANL PDS 30061B, Section 9.

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INSPECTION PROCESS OUTLINE

WANL Print 909E323d

Element Fueled (CF)

UCNC-Y-12 Print E-T-46056a

NRXA 19-hole Element
Cold Flow

<u>Item</u>	<u>Gage Type</u>	<u>Per Cent Inspection</u>
Length	Dial indicator length gage and master	100
Distance across flats	Indicating snap gage	50
Hex form	"Go" ring gage	50
Hole diameters	6" air probe and master	10
Counterbore cold end		
Depth	Indicating depth gage	20
Diameter	"Go - No Go" plug gage	20
Concentricity	0.754" ID hex ring and 0.094" OD pin located along axis of hex	100
Counterbore hot end		
Depth	Indicating depth gage	20
Diameter	"Go - No Go" plug gage	20
Concentricity	0.754" ID hex ring and 0.191" OD pin located along axis of hex	100
Bow	Surface plate and feeler gages	100
Twist	Surface plate and dial indicator	50
Notch size and location	Visual	100
Hole location	Pin gage, 0.0695" pin, all holes; 0.0825" toward outside	100
Serial number	Visual, against a graphite standard	100
Chips, broken edges	Visual	100

<u>Item</u>	<u>Gage Type</u>	<u>Per Cent Inspection</u>
Cracks	Visual	100
Surface finish	Visual - against a graphite standard	100
Surface defects	Visual - against a graphite standard	100
Perpendicularity of ends	Check machine setup only	0
Air flow	Air flow machine, 0.095" and 0.1000" standards	100
WANL Print 909E25d Fuel Element Partial (CF) UCNC-Y-12 Print E-T-46056a NRXA 19-hole Element Cold Flow		
Length	Dial indicator length gage and master	100
Distance across flats	Indicating snap gage	50
Distance across cut surface	Indicating snap gage	100
Hex form	"Go" ring gage	50
Hole diameter	6" air probe and master	10
Counterbore cold end		
Depth	Indicating depth gage	20
Diameter	"Go - No Go" plug gage	20
Concentricity	0.754" ID hex ring and 0.094" OD pin located along axis of hex	100
Counterbore hot end		
Depth	Indicating depth gage	20
Diameter	"Go - No Go" plug gage	20
Concentricity	0.754" ID hex ring and 0.191" OD pin located along axis of hex	100
Bow	Surface plate and feeler gage	100
Twist	Surface plate and dial indicator	50

<u>Item</u>	<u>Gage Type</u>	<u>Per Cent Inspection</u>
Notch size and location	Visual	100
Hole location	Pin gages, 0.0695" pin, all holes; 0.0825" toward outside	100
Serial number	Visual, against a graphite standard	100
Chips, broken edges	Visual	100
Cracks	Visual	100
Surface finish	Visual, against a graphite standard	100
Surface defects	Visual, against a graphite standard	100
Perpendicularity of ends	Check machine setup only	0
Air flow	Air flow machine, 0.0950 and 0.1000" standards	100

WANL Print 909E335 Element Unfueled (CF)

UCNC-Y-12 Print D-K-33761 NFXA Central Support Element
Cold Flow

Length	Dial indicator length gage and master	100
Distance across flats	Indicating snap gage	50
Hex form	"Go" ring gage	50
Center hole		
Diameter	"Go - No Go" plug gage, 6" long gage cold end only	50
Concentricity	0.754" ID hex ring and 0.341" OD pin located along axis of hex	100
Counterbore cold end, large		
Depth	Indicating depth gage	20
Diameter	"Go - No Go" plug gage	20
Concentricity	0.754" ID hex ring and 0.451" OD pin located along axis of hex	100

<u>Item</u>	<u>Gage Type</u>	<u>Per Cent Inspection</u>
Counterbore cold end, small		
Depth	Indicating depth gage	20
Diameter	"Go - No Go" plug gage	20
Concentricity	0.754" ID hex ring and 0.363" OD pin located along axis of hex	100
Counterbore hot end		
Depth	Indicating depth gage	20
Diameter	"Go - No Go" plug gage	20
Concentricity	0.754" ID hex ring and 0.360" OD pin located along the axis of the hex	100
Boss		
Diameter	"Go - No Go" ring gage	20
Length	Indicating length gage	20
Concentricity	0.754" ID hex ring and 0.513" ID sleeve located along the axis of the hex	100
Boss fillet radius	Radius template	20
Bow	Surface plate and feeler gage	100
Twist	Surface plate and dial indicator	50
Notch size and location	Visual	100
Serial number	Visual, against graphite standard	100
Chips and broken edges	Visual	100
Cracks	Visual	100
Surface finish	Visual, against graphite standard	100
Surface defects	Visual, against graphite standard	100
Perpendicularity of ends	Check machine setup only	0

WANL Print 909E334 Element Unfueled Multihole (CF)
 UCNC-Y-12 Print D-K-33760 NRXA Poison Element, Cold Flow

<u>Item</u>	<u>Gage Type</u>	<u>Per Cent Inspection</u>
Length	Dial indicator length gage and master	100
Distance across flats	Indicating snap gage	50
Hex form	"Go" ring gage	50
Center hole		
Diameter	"Go - No Go" plug gage, 6" long, gage cold end only	50
Concentricity	0.754" ID hex ring and 0.341" OD pin located along axis of hex	100
Counterbore cold end, large		
Diameter	"Go - No Go" plug gage	20
Depth	Indicating depth gage	20
Concentricity	0.754" ID hex ring and 0.451" OD pin located along axis of hex	100
Counterbore cold end, small		
Diameter	"Go - No Go" plug gage	20
Depth	Indicating depth gage	20
Concentricity	0.754" ID hex ring and 0.363" OD pin located along axis of hex	100
Counterbore hot end		
Diameter	"Go - No Go" plug gage	20
Depth	Indicating depth gage	20
Concentricity	0.754" ID hex ring with 0.360" OD pin located along axis of hex	100

<u>Item</u>	<u>Gage Type</u>	<u>Per Cent Inspection</u>
Boss		
Diameter	"Go - No Go" ring gage	20
Length	Indicating length gage	20
Concentricity	0.754" ID hex ring and 0.513" ID sleeve located along axis of hex	100
Boss fillet radius	Radius template	20
Hole diameters (0.100")	Air probe and master, 4" both ends	10
Counterbore, hot end - small holes		
Diameter	Air probe and master	100
Depth	Air probe and master	100
Bow	Surface plate and feeler gage	100
Twist	Surface plate and dial indicator	50
Notch size and location	Visual	100
Serial number	Visual, against graphite standard	100
Chips and broken edges	Visual	100
Cracks	Visual	100
Surface finish	Visual, against graphite standard	100
Surface defects	Visual, against graphite standard	100
Perpendicularity of ends	Check machine setup only	0

WESTINGHOUSE ASTRONUCLEAR LAB.
WESTINGHOUSE ELECTRIC CORPORATION
P.O. BOX 10844, PITTSBURGH 34, PA.

APPROVAL

AR N° 0768

PREVIOUS AR NO. _____

SUPPLIER AND ADDRESS

Union Carbide Nuclear
Post Office Box Y
Oak Ridge, Tennessee

PURCHASE ORDER NO.

SR 1855 (UN)

GOVERNMENT CONTRACT NO. (IF APPLICABLE)

PURPOSE

Radiographic Procedure
NRXA Cold Flow Core

REQUIREMENTS

WANL-QC-101
Section 3.5.7

DESCRIBE REQUEST IN DETAIL: INCLUDE TITLE, NUMBER AND REVISION OF ALL ATTACHMENTS

UNEC-Y-12 Radiographic Procedure B-3, Revision B. See attachment.

NOTE: Elements for NRXA Cold Flow Core (ND101) are being provided as Government Furnished Equipment to WANL requirements. Ordering from Union Carbide Nuclear Co., Y-12 Plant is being accomplished by SNPO-C. This AR provides documentation of WANL cognizance and approval of Y-12 process or procedure employed in meeting WANL requirements.

WHEN SEPARATED FROM ENCLOSURES, HANDLE THIS

DOCUMENT AS Unclassified
(INSERT PROPER CLASSIFICATION)

SUPPLIER'S AUTHORIZED REPRESENTATIVE

#. M. 10001

TITLE: UNEC-Y-12 Radiographic Procedure B-3, Revision B

DATE: 6-6-63

WANL DISPOSITION

DESIGN ENGINEERING

TITLE

DATE

RELIABILITY

QUALITY CONTROL

OK

6-11-63

OTHER

Warrin 6-21-63

FINAL DISPOSITION

☒ APPROVED

☐ CONDITIONALLY APPROVED

☐ DISAPPROVED

PG 21 WANL 1000 A

Testing
Procedure

PHYSICAL TESTING

UNION CARBIDE NUCLEAR COMPANY
DIVISION OF UNION CARBIDE CORPORATION

Y-12 PLANT

Type Radiography	Spec. No. 4	Dwg. No. 909E324 (Typical)	Process No.
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1. SCOPE

This procedure covers the radiographic inspection of unloaded graphite fuel elements for NRXA Cores of which Westinghouse drawing number 909E324 is typical.

2. GENERAL REQUIREMENTS

2.1 Resolution

Resolution shall be sufficient to detect defects to adequately grade each element per specifications shown on Westinghouse drawing number 909E324 and will be controlled by the techniques and methods described in this procedure.

2.2 Coverage

Each element shall be radiographed over 100 percent of its length at 0 degree, 120 degrees, and 240 degrees positions.

2.3 Film Density

The film shall be 2.0 ± 0.3 through the axial bore.

2.4 Film Artifacts

The radiographic image area shall be as free of detectable scattered radiation as is practical under production methods. The processed film shall show no evidence of fogging and shall show no artifacts or streaking that might affect interpretation.

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*Testing
Procedure*

PHYSICAL TESTING

UNION CARBIDE NUCLEAR COMPANY

DIVISION OF CORPORATION

Y-12 PLANT

Type	Radiography	Spec. No.		Dwg. No.	909E324 (Typical)	Process No.	
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3. EQUIPMENT

The following equipment or its equivalent shall be used:

3.1 Source of Radiation

Norelco 150 X-ray Generator - 10 to 50 KV with Beryllium Window X-ray tube.

3.2 Film Holder

14" x 17" Aluminum open front 0.0625" bulk wall thickness.

3.3 Radiographic Film

Eastman, Ready Pack, Type M

3.4 Film Screen Arrangement

OMMO/125

3.5 Development

The film shall be developed in an automatic film processing machine.

3.6 Element Number

Each view shall show the element number by mounting radiographically sound lead numerals on a number plate in such a way that their images appear near the edge of the view.

4. PROCEDURES

Setup details for radiography will be as follows:

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Testing
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PHYSICAL TESTING

UNION CARBIDE NUCLEAR COMPANY

DIVISION OF UNION CARBIDE CORPORATION

Y-12 PLANT

Type	Spec. No.	Dwg. No.	Process No.
Radiography		909E324 (Typical)	

4. PROCEDURES (Continued)

4.1 Orientation of element on Positioning fixture

Four elements will be placed on the positioning fixture at one time. The numbered or No. 1 flat will be turned toward the x-ray head during all 0 degrees or first exposures. The numbered end of the element will be supported by a plastic cap with six fingers that conform to the hexagonal shape of the element. The un-numbered end of the element is supported by a narrow strip of plastic tape or similar low absorber.

4.2 Number of Views

12 each

4.3 Arrangement of Views

One section of a maximum of four elements may be radiographed on one cassette. Each element is positioned so that a beam of radiation from the target coincides with the plane perpendicular to two opposite sides or flats of the hexagonal element. The images of the bores in a plane which coincide to an X-ray beam that passes through the bores will superimpose on each other on the film. Masking bars are arranged parallel to each side of the four elements so that the film area for the 120 degrees and 240 degrees views remain unexposed while the 0 degree view is being exposed. After each element rotates clockwise 120 degrees, as viewed from the numbered end, the film moves forward about 1 inch to make the next exposure. Each view covers about 14" of the element length.

4.4 Target - Film Distance

48 inches

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PHYSICAL TESTING

UNION CARBIDE NUCLEAR COMPANY

DIVISION OF CORPORATION

Y-12 PLANT

Type	Radiography	Spec. No.		Dwg. No.	909E324(Typical)	Process No.	
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4. PROCEDURES (Continued)

4.5 Exposure Factors

Element	Kilovoltage	Filter At Tube	Exposure (MA-SEC)
19 hole	40	None	110
13 hole	40	None	110
12 hole	40	None	100
1 hole	40	None	140

4.6 View Identification

The 0 degree view will be identified as being the left image of a group of three images of the same element. The second image will be the 120 degrees view and the third image will be the 240 degrees view. Each of the above views will contain the same element number.

4.7 Section Identification

Radiographs of each of four sections may be identified by the position of the part number bridge image and/or the image of the ends of the element. The No. 1 section radiograph shows the "cold" end of the element with the part number bridge at the top of the film. The No. 2 section shows the number bridge at the bottom of the film. The No. 3 section shows the number bridge at the top of the film and the No. 4 section shows the number bridge at the bottom of the film with the "hot end" of the element at the top of the film.

4.8 Element Identification Numbers

The identification number for each element is projected on the film outside the element image to be interpreted.

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TABLE II

Radiographic Specifications for WANL Cold Flow. All values listed below are "Allowable" values.

Grade	Transverse Cracks	Axial Cracks				Low Density Areas			Inclusions		
	Number	Number	Size	Separation	Transverse Projection	Number	Size	Separation	Number	Size	Separation
I	None	None	--	--	--	Any	<0.030"	Any	Any	<0.030"	Any
II	None	5	$\frac{1}{4}$ " long x <0.010" wide	$\frac{1}{4}$ "	0.030"	5	0.060"	$\frac{1}{4}$ "	5	0.060"	$\frac{1}{4}$ "
III	None	10	$\frac{1}{4}$ " long x <0.010" wide	$\frac{1}{4}$ "	0.030"	10	0.060"	$\frac{1}{4}$ "	10	0.060"	$\frac{1}{4}$ "
IV	None	Any	<4" long x <0.010" wide	Any	0.030"	>10	0.060"	Any	>10	0.060"	Any
V											
VI	Any	Any	$\frac{1}{2}$ " long x >0.010" wide	Any	>0.030"	Any	>0.060"	Any	Any	>0.060"	Any

If a condition exhibits a generally porous or unsound condition, in the opinion of the radiographer, an element will be rejected even though the above specifications have been met.