REFERENCE

IC-5373 (ISFS-1304)

From: Instrumentation and Control

Date: November 5, 1965

Subject: WANL-TMI-1587, "Instrumentation Handling, Storage and Transporting Methods"

ASTRONUCLEAR LABORATORY

To: All SAE Personnel
W. O. Anthony
W. H. Baker
M. J. Regenda
L. P. Pollono
R. W. Kaisner
R. A. Kelly
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Attached is a copy of the subject document. It is intended that all handling of instrumentation for ND 10501 and subsequent reactors conform to this document. The following documents form a part of WANL-TMI-1587.

1. ISFS-1167 dated September 3, 1965, R. R. Swope to M. J. Regenda, "Placement of Plastic Protective Caps on Exposed Junction Thermocouples."
2. ISFS-1253 dated October 16, 1965, E. K. Figenbaum to T. C. Burlas, "Lead Handling."

It should be noted ISFS-1167 stated the protective cap method would be incorporated on Equipment Specifications, Process Specifications and drawings. This method will be picked up on the appropriate E-Spec which is a part of the applicable drawing and also on the applicable Acceptance Test Process Specification.

EKFigenbaum
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Attachment: (1)

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MASTER

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WANL-TMI-1587
INSTRUMENTATION HANDLING, STORAGE
AND TRANSPORTING METHODS

1. SCOPE

This TMI describes the method that shall be used for the handling, storage and transporting of instrumentation from Sensor Application Engineering (SAE) into Reactor Assembly.

2. REQUIREMENTS

- 2.1 Instrumentation of reactor grade that is transported from SAE into Reactor Assembly shall be uncoiled and straight. Storage and transporting tubes shall be used for this operation (see Figure 1).
- 2.2 Storage and transporting tubes containing exposed junction thermocouples shall be purged and pressurized 2 to 5 psi with dry nitrogen.
- 2.3 Placement of reactor instrumentation in the tubes shall be regulated by the quantity required for a particular assembly and the part numbers of the sensors.
- 2.4 Sensors shall be arranged in the tubes by keeping the same part numbers assigned to the tube together and separated from the other sensors by leaving an empty hole or holes between the groups.
- 2.5 Placement of spare sensors in tubes shall be regulated by the part numbers of these sensors.
- 2.6 Some copper-constantan thermocouples shall have measurement numbers assigned. The measurement number shall be stamped on shrink tubing per Process Specification PS-294581-3. This tubing shall be positioned and shrunk in place on the sensor, one inch behind the existing shrink tubing at the readout end.

3. OPERATION - REACTOR INSTRUMENTATION

3.1 Preparation of Sensor by SAE for Storage and Transporting

- 3.1.1 The sensing end of the exposed junction thermocouples (945C906) shall be protected by a plastic cap per Process Specification PS-294635, Thermocouple Acceptance Procedure.
- 3.1.2 Shrink tubing shall be placed over the 978D270, 978D186 and the 979D149 thermocouples. See Table I for length and shrink tubing description. The shrink tubing shall extend beyond the sensing end by two inches and the last 1-1/2 inches on each end shall be shrunk, enclosing the sensing end within the tubing. Extreme care shall be taken not to shrink the tubing on the tungsten coating (978D270), the tungsten sheath (979D149), or the small (.020) diameter (978D186) portion of the thermocouples.
- 3.1.3 The sheath cables shall be cut to the length selected between the minimum and maximum lengths shown on memo ISFS-1253, Lead Handling, dated October 16, 1965. (Copy attached)
- 3.1.4 A wire straightener shall be used to straighten metal sheath cables making sure that the cable is not nicked or pinched between the rollers. After straightening, the cables shall be cleaned of grease or other foreign substances.
- 3.1.5 Strip the sheath and moisture seal cable per Process Specification PS-294624 and protect the readout end as required.
- 3.1.6 Perform same electrical measurements as during acceptance testing and record data on appropriate history sheet in the acceptance test section.

- 3.1.7 The sensors shall be inserted in the tube from the 3 inch diameter end of the tube (see Figure 1).

Exposed junction thermocouples shall be inserted readout end first.

Grounded junction thermocouples shall be inserted sensor end first.

Pressure transducers, accelerometers, lateral support spring strain gages, and LVDT's shall be inserted readout end first. Kempak shall be placed around each transducer to separate them from each other and the wall of the box.

- 3.1.8 The vendor's identification tag shall be positioned 1 inch from the sensing end of exposed junction thermocouple. The vendor's identification tag of sensors entering the tube sensing end first shall be positioned 1-1/2 inches from the readout end. The vendor's identification tag shall be positioned as close as possible to the lateral support spring assembly.

- 3.1.9 A tag shall be affixed to the tube stating the contents of the tube by part number, serial number and assembly.

- 3.1.10 Teflon tape shall be placed around the threads, the end caps screwed on hand tight and an additional one turn by wrench shall be applied.

- 3.1.11 Tubes containing exposed junction thermocouples shall have valves located at both end of the tube. The tube shall be purged for 30 seconds at 15 psi with dry nitrogen by attaching 1/4 inch metal tubing from the regulator on the dry nitrogen tank to the Inlet Pressure Valve (see Figure 1). Open both Inlet and Outlet Pressure Valves and proceed

purging tube. After 30 seconds decrease pressure to 2 to 5 psi and close Outlet Pressure Valve. After one minute close Inlet Pressure Valve, turn off nitrogen source, and remove 1/4 inch tubing from the valve.

3.1.12 When the tubes containing the proper sensors per ISFS-1253 are completed they shall be stored in the SAE Lab.

3.2 Reactor Instrumentation - Reactor Assembly

3.2.1 Reactor Assembly shall notify SAE or Program Control for the tube containing specific assembly instrumentation needed and their history sheets. Tubes shall not be opened in Reactor Assembly until sensors are required for installation.

3.2.2 Electrical checks shall be performed immediately upon removal of sensors from the tube and shall be recorded on the appropriate history sheet in the "Before Installation" column.

3.2.3 If sensors are to be reworked prior to installation another electrical check shall be made after reworking and before installation. This electrical check shall be labeled "After Rework" on the history sheet.

3.2.4 Tubes as they are emptied shall be returned to SAE.

4. SPARE INSTRUMENTATION

4.1 The following operations shall be done by SAE.

4.1.1 Preparation of sensors shall proceed as stated in steps 3.1.1 through 3.1.8.

4.1.2 The spare sensors shall be inserted in the tubes per ISFS-1253 and steps 3.1.9.

4.1.3 A tag shall be affixed to the tube stating the contents of the tube by part number and serial number.

4.1.4 Proceed as in step 3.1.11.

4.1.5 Proceed as in steps 3.1.12 and 3.1.13 when applicable.

4.2 Operation by Reactor Assembly Concerning Spares

4.2.1 Reactor Assembly shall notify SAE of the specific sensor and history sheet required.

4.2.2 SAE will coordinate in obtaining and transporting the sensor in its plastic tube from NERVA Stores or SAE Lab to Reactor Assembly.

4.2.3 Perform check as in step 3.2.2.

4.2.4 If sensor is reworked, proceed as in step 3.2.3.

4.2.5 The plastic tube shall be returned to SAE.

TABLE I

<u>Part No.</u>	<u>Diameter of Sensing End</u>	<u>Length of Shrink Tubing</u>	<u>Size of Shrink Tubing and Type</u>
978D270H01	0.090 to	23"	3/32" I.D. PVC
978D270H02	0.097	29"	
978D270H03		35"	
978D186H01	0.020	66"	1/16" I.D. PVC
978D186H02			
979D149H01	0.060	8"	3/32" I.D. PVC

Inlet Pressure Valve

Outlet Pressure Valve

A-A

List of Materials

- 1 1/4" Imperial needle Valve
- 2 1 1/2" End Cap, Galvanized Steel
- 3 1 1/2" Alum. Conduit, Rigid
- 4 1 1/2" Coupling, Alum.
- 5 2"-1 1/2" Reducer, Galvanized Steel
- 6 2" Close Nipple, Galvanized Steel
- 7 2" End Cap, Galvanized
- 8 1/4" Plastic tubing
- 9 10" Deep X 8" Square Adaptor

NOTE

1. Fixture will be purged
With Dry Nitrogen & is
capable of storing 25-28
Thermocouples

2. Item #9 will be used for
LVDT's, Pressure xducers
Lateral support. Springs
Accelerometers

Sensor Application Eng.

C.A. FATYOL 8-18-65

SAE-SK-126

FIGURE 1

SHEET 1 of 2

WESTINGHOUSE ELECTRIC CORPORATION

SAE-SK-126

8-18-65
CAF

1. $\frac{1}{8}$ " Thermofit SCL Type Shrink Tubing

2. $\frac{1}{4}$ " Rigid Plastic Tubing (Clear)

3. $\frac{1}{4}$ " Thermofit SCL Type Shrink Tubing

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SAE-SK-12B

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IC-5159 (ISFS-1167)

From Instrumentation and Control

Date September 3, 1965

Subject Placement of Plastic Protective Caps on Exposed Junction Thermocouples

ASTRONUCLEAR LABORATORY

To: M. Regenda

cc: All SAE Personnel
F. Malick
R. Kaiser
G. Conegan
H. Baker
R. Kelly
E. McQuade
J. Hutchinson
G. Wagner
F. Henning

Recently it was noted that exposed junction thermocouples were being received from the vendor with another change in junction protection cap design. The placement of protective caps on exposed junction thermocouples such as the 945C906H01 and H02 is to protect the sensing end from being deformed or damaged. The various types of caps used to date for the protection of the sensing end have been inadequate. In order to standardize on a single cap design the following method of protection has been applied and proven and shall be incorporated in the existing Equipment Specifications, Process Specifications and Drawings issued for this type of thermocouple.

The procedure is as follows:

<u>Material Required</u>	<u>Subject</u>
1. 1/8" Thermofit SCL Type Shrink Tubing	945C906H01 and H02 - 0.063 in. dia. sheath exposed junction type thermocouple
2. Standard 1/4" OD with a 1/8" ID Clear Rigid Plastic Tubing	
3. 1/4" Thermofit SCL Type Shrink Tubing	

1. Position item No. 1 (1/8" shrink tubing) 1-1/8" inches down the sheath cable from where the sensing end exits the sheath shrink in place with heat gun.
2. Item No. 2 (clear rigid plastic tubing) is then placed over the shrunken tubing with 3/8" inches protruding beyond where the sensing end exits the sheath.
3. Position item No. 3 (1/4" shrink tubing) over the rigid plastic tubing 1 inch down the sheath cable from where the sensing end exits the sheath. Shrink in place with heat gun.

NOTE: Area in which shrink tubing is to be placed must be free of Aerosol and any other oily substance.

R. R. Swope / del

R. R. Swope, Supervisor
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1. $\frac{1}{8}$ " Thermofit SCL Type Shrink Tubing

2. $\frac{1}{4}$ " Rigid Plastic Tubing (Clear)

3. $\frac{1}{4}$ " Thermofit SCL Type Shrink Tubing

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SAE-SK 123

ISFS-1253

ASTRONUCLEAR LABORATORY

T. C. Burles

Instrumentation and Control

October 16, 1965

cc: R. R. Swape
C. A. Futyl

Lead Handling

A complete report on the method of lead handling from Acceptance/Calibration Testing until the sensors are installed by Reactor Assembly is forthcoming--hopefully in one week.

Listed here are the sensors to be used in NRX-A5 by part number and their major location to be installed. Beside these items are minimum and maximum cable lengths. It will be acceptable for the sensors to be installed in the aluminum tubes with any cable length between these minimum and maximum values.

<u>945C906H01 (Total 51)</u>	<u>Minimum</u>	<u>Maximum</u>
12 Shield	170	280
12 O.R. Inlet Plenum	258	260
2 Support Ring	150	260
22 Core Support Plate	180	260
3 Control Drum-Gas	200	260
<u>963B363H01 (Total 6)</u>	<u>Minimum</u>	<u>Maximum</u>
4 O.R. Sector	225	260
2 Core Support Plate	170	260
2 I.R. Spring Bar	175	260
<u>963B362H01 (Total 4)</u>		
4 Inner Reflector	210	260
<u>963B361H01 (Total 1)</u>		
1 Filler Block	170	260
<u>964B039H02 (Total 6)</u>		
2 O.R. Tie Bolts	225	260
Control Drums	288 #	288 #

T. C. Burles

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ISFS-1253

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<u>978D186H01 (Total 7)</u>	<u>Minimum</u>	<u>Maximum</u>
7 Tie Rod Material	225	260
<u>978D186H02 (Total 8)</u>		
6 Stations 1/2" & 1	175	260
2 NRX-A6 Lateral Support Spring	*	260
<u>978D213H01 (Total 8)</u>		
8 Station 8	180	260
<u>978D270H01 (Total 8)</u>		
8 Station 20	190	260
<u>978D270H02 (Total 28)</u>		
28 Station 26	250	260
<u>978D270H03 (Total 12)</u>		
12 Station 32	215	260
<u>978D149H02 (Total 21)</u>		
21 Support Block	*	260
<u>945C923H04 (Total 1)</u>		
Shield	155	260
<u>945C434H05 (Total 1)</u>		
Shield	155	260
<u>978D227H02 (Total 2)</u>		
Control Drum	258	260
<u>978D193H02 (Total 3)</u>		
Core Support Plate	170	260

T. C. Burlas

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ISFS-1253
October 16, 1965

<u>278D211H04 (Total 10)</u>	<u>Minimum</u>	<u>Maximum</u>
Tia Rod	#	#
<u>946C117H01 (Total 6)</u>		
Lateral Support Spring	195	260
<u>946C921H01 (Total 3)</u>		
Core Support Plate	170	260

* These dimensions will be obtained as soon as Reactor Design stipulates the routing of these leads.

* The leads of these cables will remain as long as possible and will be coiled for storage and transfer into Reactor Assembly.

Attached is a composite summary of the NRX-A5 sensors and to which aluminum tube they shall be installed. Under the heading of "Instruments per tube" is a bracket and a number. Each bracket represents a different tube and the number represents the quantity of sensors for that tube. There will be 11 tubes for reactor instrumentation plus 5 more tubes for the spare instrumentation. The "minimum length" shown for each sensor is the absolute minimum as calculated from the assembly drawings--this is not the length to be sent into Reactor Assembly.

E. K. Figenbaum

E. K. Figenbaum
Sensor Application Engineering - ISFS
Instrumentation and Control

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Attachment

ASSEMBLY SIMULATED SHIELD

NRX-A5
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PART NO.	MEAS NO.	SER. NO.	INST. PER. TUBE	MIN. LENGTH	COMMENTS
945C906H01	T501		12	133"	EVP. ICT. T/C
	T502			140"	
	T503			140"	
	T504			140"	
	T505			134"	
	T506			119"	
	T508			105"	
	T509			132"	
	T510			139"	
	T511			139"	
	T512			141"	
945C906H01	T513			133"	
945C923H04	P306		2	128"	
945C934H05	P602			128"	

ca. 10-13-65

ASSEMBLY OUTER REFLECTOR

NRX-A5

EST.

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PART NO	MEAS NO	SER. NO	INST. PER. TUBE	MIN. LENGTH	COMMENTS
963B363H01	T306			160"	SECTOR #12
	T307			172"	
	T310			184"	
963B363H01	T311			197"	SECTOR #12
964B039H02	T312			160"	TIE BOLT #17
	T313			200"	TIE BOLT #35
	T360			264"	INSTRUMENTED CONTROL DRUM
	T361			264"	
	T362		THESE T/C WILL BE SENT TO RA. IN 12" COILES	288"	
964B039H02	T363			288"	
945C906H01	T343			156"	CONTROL DRUM GAS. TEMP
	T344			150"	SECTOR EXIT GAS. TEMP
	T348			168"	C.D. VANE GAS TEMP
	T370			232"	REFL. INLET PLENUM
	T371			244"	
	T372			232"	
	T373			220"	
	T374			208"	
	T375			196"	
	T376			184"	
	T377			172"	
	T378			184"	
	T379			208"	
	T380			220"	
945C906H01	T381			220"	REFL. INLET PLENUM

PART NO	MEAS NO	SER. NO	INST. PER. TUBE	MIN. LENGTH	COMMENTS
978D270H02 (continued)	T625 T626		28	153" 153"	26" STATION T/C
↑	T710 T711 T712				HOT BUFFER PERIPHORY
↓	978D270H02 T713				
978D270H03	T610 T614 T619 T627 T634 T652 T659 T671		25	190" 189" 181" 179" 173" 165" 173" 172"	32" STATION T/C
↑	T714 T715 T716				HOT BUFFER PERIPHORY
↓	978D270H03 T717				
978D186H01	T760 T765 T768 T750 T766 T755			198" 191" 181" 195" 180" 179"	TUBE LINER T/C
↑	978D186H01 T763			187"	
↓	978D186H02				
↑	T682 T683 T684 T685 T686 T687			146" 146" 127" 127" 127" 127"	1" 5/2" STATION T/C
↓	978D186H02				
978D211H04	M701 M702 M703 M704 M705 M706 M707 M708				These strain Gages will be sent to RA in 12" coils (Tie Rod Gages)
↑	978D211H04 M709				
↓	978D211H04 M710				

PART NO	MEAS NO	SER. NO	INST. PER. TUBE	MIN. LENGTH	COMMENTS
979D149H02	T688				CLUSTER EXIT GAS.
	T689				
	T690				
	T691				
	T692				
	T693				
	T694				
	T695				
	T696				
	T697				
	T698				
	T699				
	T700				
	T701				
	T702				
	T703				
	T704				
	T705				
	T706				
	T707				
979D149H02	T708				

PART NO	MEAS NO	SER. NO	INST. PER. TUBE	MIN. LENGTH	COMMENTS
945C906H01 ↑ ↓	T 776		24	146"	STAKED IN CORE SUPPORT PLATE
	T 777			148"	
	T 778			151"	
	T 779			132"	
	T 780			141"	
	T 781			136"	
	T 782			133"	
	T 783			127"	
	T 784			127"	
	T 785			136"	
	T 786			141"	
	T 787			143"	
	T 788			132"	
	T 789			135"	
	T 790			128"	
	T 791			141"	
	T 792			141"	
	T 794			138"	
	T 795			131"	
	T 796			128"	
	T 797			134"	
	T 798			130"	
	T 431			122"	STAKED IN CORE SUPPORT RING
	T 434			122"	
945C906H01	T 406		10	153"	INNER REFL. MATERIAL TEMP.
↑ ↓	T 407			153"	
	T 911			141"	
963B362H01	T 412			177"	
↑ ↓	T 413			150"	INTERNAL SUPPORT SPRING RETAINER BAR TEMP
	T 414			150"	
	T 773			136"	CORE SUPPORT PLATE
963B363H01	T 774			144"	
978DIS6H02	T 608				NAY-AL Internal Support SPRINGS
	T 609				

ASSEMBLY REACTOR ASSEMBLY

NRK-AS

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PART NO	MEAS NO	SER. NO	INST. PER. TURE	MIN. LENGTH	COMMENTS
978D227H02 ↑	H301 H302		}	207"	CONTROL DRUM ACC.
978D193H02 ↑	H701 H702 H703			145" 143" 144"	CORE SUPPORT PLATE ACC.
945C921H01 ↑	D701 D702 D703			141" 138" 135"	CORE SUPPORT PLATE LUDT'S
946C117H01 ↑ ↓	M415 M416 M419 M420 M423 M424			152" 168" 152" 168" 152" 168"	INSTRUMENTED LATERAL SUP. SPRINGS
746C117H01					

PART NO	MEAS NO	SER. NO	INST. PER. TURE	MAN. LENGTH	COMMENTS
445C906H01			10		Exp. Jct
978D013H01			2	14	20' station T/c 264 321
978D270H01			2		
978D270H02			7		
978D270H03			3		
963B363H01			2	13	
963B362H01			1		
963B361H01			1		
978D186H01			2		
978D186H02			2		
979D149H02			5		
964B037H02			2		will be stored coiled
978D0211H04			3		will be stored coiled
446C117H01			4 34		
978D2271H02			1	5	
978D193H02			1		
945C921H04			2		
945C934H05			1		