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REON
SACRAMENTO PLANT

REPORT NO. RN - S - 0225

TO

AEC - NASA SPACE NUCLEAR PROPULSION OFFICE

NES DUCT INSTRUMENTATION
INSTALLATION PROCEDURES

MARCH 1966

NERVA PROGRAM

CONTRACT SNP-1

MAILED

AEROJET GENERAL CORPORATION

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ROCKET ENGINE OPERATIONS - NUCLEAR

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SCOPE

This document is written to define the procedures to be followed in receiving and installing instrumentation components for use on the NES Duct. Both temporary and permanent instrumentation components will be covered; further the temporary components will include those to be removed after the design demonstration test and those to be left installed but electrically disconnected after the design demonstration test. This document does not cover certain items to be installed on the test stand piping or facility structure.

O. M. Rice
Program Manager
REON

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1. GENERAL INSTRUCTIONS

- 1.1 Discrepancies noted in accomplishment of any section of this procedure shall be brought to the attention of the Assembly Engineer and Quality Control representatives for resolution. All material discrepancies will be appropriately recorded.
- 1.2 Photographs shall be made of all defects and irregularities in accordance with NTO-SOP-0008. In addition, photographs shall be taken of completed duct-mounted installations. The photographs will identify the component by tag number and measurement number. This shall be accomplished under the direction of the cognizant NTO engineer.
- 1.3 A daily record of the installation operation will be maintained by the shift engineers.
 - 1.3.1 The electrical checkout equipment employed will carry a valid calibration sticker. The model numbers and serial numbers of test equipment used will be recorded in the daily record of Paragraph 1.3, above.
- 1.4 All measurements and all steps in the installation shall be recorded and verified by Quality Control on the appropriate Instrumentation Data Log Sheet. The steps are sequential and any irregularities shall be resolved before proceeding with the next operation.
- 1.5 NTO Standard Operation Procedures shall be used to supplement this procedure. In the event of conflict, the more restrictive shall apply; the cognizant NTO engineer shall determine the applicable procedure.
- 1.6 Instrumentation leads will not be tensile loaded and the flexing of leads will be minimized during installation or routing. All metal sheathed cables shall be formed over appropriate mandrels and shall not be bent to an inside radius smaller than 5 cable diameters, or kinked. All cables

will be routed per the appropriate installation drawings and will be installed in such a manner that any one may be removed without removing any other cable. (See NOTE below).

- 1.7 A 50 volt dc megger will be used for insulation resistance tests in receiving inspection and subsequent tests.
- 1.8 Reference to ground in this procedure refers to the appropriate circuit ground. The applicable schematic should be used in conjunction with all tests. The ground point is floating on the duct end in all cases except the thermocouples.
- 1.9 NTO Health and Safety Instructions RN-HSM-0001 and Workmanship Standards Manual NTO-SOP-0044 shall be followed in the performance of this procedure.
- 1.10 Changes, additions and deletions of tolerances, as specified, shall be authorized in writing by the cognizant NTO engineer or his designated alternate.
- 1.11 Any component that is dropped, shocked or otherwise handled in a manner not consistent with good instrumentation practice shall be subject to re-inspection and shall be retested electrically to insure that it is still undamaged and operational. The occurrence shall be recorded on the appropriate instrumentation Data Log Sheet and in the daily log.
- 1.12 The circled numbers in the body of this document refer to the operations to be recorded on the Instrumentation Data Log Sheets.

NOTE: CAUTION - Straightening of metallic sheathed electrical cables that have been bent to a radius of less than 75 cable diameters will severely jeopardize the integrity of the electrical conductors and insulation. Therefore, bends the radius of which are less than 75 cable diameters are to be considered permanent.

1.13 Component Receiving Requirements

- 1.13.1 Unpacking - General: All components will be unpacked in an enclosed area free of blowing dust, sand, and grit. The area will be controlled to the extent considered necessary by the Quality Assurance Division representative to maintain accountability and cleanliness of components.
- 1.13.2 Accountability - The unpacking will be carried only as far as necessary to determine that the proper quantity of parts of the proper part number have been received. The proper part numbers and quantity will be those indicated in the appropriate Basic Parts List. If it is desirable to conduct receiving electrical checks at this time, unpacking may be carried out to the extent necessary to perform the checks as indicated. Assure that all required calibration data and certifications have been received.
- 1.13.3 Visual Inspection - All parts will be visually examined at this time for obvious shipping or handling damage. If such damage is apparent, a brief description of the damage shall be logged on the Instrumentation Data Log Sheet. The requirements of Quality Reliability Instruction Manual, NTO-A-0013 shall be met during performance of the work specified herein.
- 1.13.3 Electrical Inspection - All transducers will be subjected to the following minimum inspection to insure there is no internal damage.

Insulation Resistance - Using a 50 vdc megger, measure the insulation resistance between each pin and ground. Record the measured values in the space provided on the Instrumentation Data Log Sheet.

Circuit Resistance - Using a $\pm 1.0\%$ instrument measure and record the resistance between pins as indicated on the Instrumentation Data Log Sheet.

NOTE: The decision to calibrate each transducer upon receipt at NTO rests with the cognizant NTO engineer. Should the transducers be recalibrated at NTO, reference should be made to the applicable drawing, specification, and any previous deviations granted thereto.

1.14 Storage - If the units are not to be immediately installed, they shall be stored in a controlled access area. Access to the instrumentation components shall be limited to the NTO Assembly Instrumentation Engineer or his designated alternate. The storage area shall be controlled to the extent considered necessary by the Quality Assurance Division representative to maintain accountability, cleanliness, and to insure proper handling of the components. After removal of the component from storage, the electrical checks of the electrical receiving inspection shall be repeated prior to mounting the unit on the NES Duct as a part of the installation procedure. Verify this in the proper location on the Instrumentation Data Log Sheet (2).

2. REFERENCE MATERIAL

2.1 DRAWINGS

2.1.1 COMPONENT DRAWINGS

<u>Drawing Title</u>	<u>Drawing No.</u>
THERMOCOUPLE, IMMERSION-CHROMEL-ALUMEL	1-236086-60
TRANSDUCER, PRESSURE-0-100 PSIA	248812
TRANSDUCER, PRESSURE-0-1000 PSIA	248816
THERMOCOUPLE, IMMERSION-CHROMEL-ALUMEL	267624
ACCELEROMETER, ELECTRICAL, PIEZOELECTRIC	701565
LIMIT SWITCH ASSEMBLY-PLUNGER ACTUATED TYPE	1013626
THERMOCOUPLE, IMMERSION-CHROMEL-ALUMEL	1013627
THERMOCOUPLE-SURFACE TEMPERATURE SENSING CHROMEL-ALUMEL	1013628
THERMOCOUPLE, IMMERSION-CHROMEL-ALUMEL	1013629
STRAIN GAGE ASSEMBLY, ONE HALF BRIDGE, WELDABLE	1013630
TRANSDUCER, VIBRATION, STRAIN GAGE-NES DUCT	1013631
TRANSDUCER, PRESSURE, STRAIN GAGE-NES DUCT	1013633
TRANSDUCER, PRESSURE, DIFFERENTIAL, STRAIN GAGE, NES DUCT	1013634
THERMOCOUPLE-IMMERSION, CHROMEL-ALUMEL	1013635
LIMIT SWITCH ASSEMBLY, ROLLER ACTUATOR TYPE	1013636
TRANSDUCER, PRESSURE, STRAIN GAGE-NES DUCT STEAM HEADER	1013641
THERMOCOUPLE-SURFACE TEMPERATURE SENSING, CHROMEL-ALUMEL	114821

2.1.2 SUB-ASSEMBLY DRAWINGS

<u>Drawing Title</u>	<u>Drawing No.</u>
INSTRUMENTATION BOOM	1013625
FRAME ASSEMBLY, REMOTE DISCONNECT-GN ₂ LINE	1115248

2.1.2 SUB-ASSEMBLY DRAWINGS (CONT.)

<u>Drawing Title</u>	<u>Drawing No.</u>
CABLE ASSEMBLY, SPECIAL PURPOSE 6 COND - NES DUCT	1013637
CABLE ASSEMBLY, SPECIAL PURPOSE, 6 COND - NES DUCT TEMPORARY I & C	1013638
CABLE ASSEMBLY, SPECIAL PURPOSE, 3 COND - NES DUCT	1013639
CABLE ASSEMBLY, SPECIAL PURPOSE, ACCELEROMETER NES DUCT	1013640
CABLE ASSEMBLY, THERMOCOUPLE EXTENSION - NES DUCT	1114636
WIRING HARNESS, TEMPORARY INSTRUMENTATION TEMPORARY ENGINE COMPARTMENT	1114672
WIRING HARNESS, TEMPORARY INSTRUMENTATION Temporary engine compartment	1114673
FLANGE - INSTRUMENTATION CONNECTOR TEC	1114675
FLANGE - INSTRUMENTATION CONNECTOR TEC	1114676
ADAPTER, SPECIAL	1114699
BRACKET, MOUNTING - TRANSDUCER	1114700
BLOCK, MOUNTING - TRANSDUCER	1114701
STRAP, RETAINING - TRANSDUCER	1114702
BRACKET, TRANSDUCER	1114718
BRACKET, MOUNTING	1114719
STRAP, RETAINING - TRANSDUCER	1114720
TUBE ASSEMBLY, METAL	1114739
CABLE ASSEMBLY, SPECIAL PURPOSE	1114740
CAP, ACCELEROMETER	1114743
COVER, ACCELEROMETER	1114744
BRACKET, MOUNTING - ACCELEROMETER	1114745
CUSHION, RUBBER	1114771
ARM ASSEMBLY - TRANSDUCER CLAMP	1114931
ARM ASSEMBLY - TRANSDUCER CLAMP	1114932
BRACKET, MOUNTING - ACCELEROMETER	1114998
BRACKET, MOUNTING - ACCELEROMETER	1114999
BRACKET, MOUNTING - ACCELEROMETER	1115000

2.1.2 SUB-ASSEMBLY DRAWINGS (CONT.)

<u>Drawing Title</u>	<u>Drawing No.</u>
BRACKET, MOUNTING - ACCELEROMETER	1115001
BRACKET, MOUNTING - ACCELEROMETER	1115002
BRACKET, MOUNTING - ACCELEROMETER	1115003
BRACKET, MOUNTING - ACCELEROMETER	1115004
CLAMP ASSEMBLY, TRANSDUCER	1115007
CLAMP ASSEMBLY, TRANSDUCER	1115008
ARM, TRANSDUCER CLAMP	1115009
ARM, TRANSDUCER CLAMP	1115010
ADAPTER, CLAMP ASSEMBLY	1115011
BASE, MOUNTING - TRANSDUCER CLAMP	1115012
BASE, MOUNTING - TRANSDUCER CLAMP	1115013
BOLT, CLAMP ASSEMBLY	1115014
PLATE, BACKING	1115016
PLATE, SIDE - MOUNTING BLOCK	1115038
PLATE, BASE - MOUNTING BLOCK	1115039
BLOCK, MOUNTING - TRANSDUCER	1115040
BLOCK, MOUNTING	1115043
BRACKET, MOUNTING	1115044
SUPPORT, CABLE - WELDMENT	1115045
MOUNT, CONNECTOR	1115046
ANGLE, CABLE PROTECTOR	1115047
CLAMP, LOOP	1115059
CLAMP, CABLE	1115158
BRACKET, SWITCH	1115221
CLAMP, CABLE	1115226
UNIVERSAL JOINT	1115239
ADAPTER, FLARED TUBE	1115240
BRACKET, JOINT - REMOTE DISCONNECT	1115241
FRAME, MOUNTING - WELDMENT	1115247
JOINT ASSEMBLY, REMOTE DISCONNECT	1115249
BRACKET, DISCONNECT, UPPER TRUSS	1115251

2.1.2 SUB-ASSEMBLY DRAWINGS (CONT.)

<u>Drawing Title</u>	<u>Drawing No.</u>
TUBE ASSEMBLY, METAL	1115253
TUBE ASSEMBLY, METAL	1115254
TUBE ASSEMBLY, METAL	1115255
JOINT ASSEMBLY - WELDMENT	1115268
BRACKET	1115322
BRACKET	1115323
COVER	1115333
GASKET	1115334
BLADE, AIR MOTOR	1115489
MOTOR, AIR - MODIFIED BLADE	1115490
ADAPTER, FLARED TUBE	1115789
COVER, ACCELEROMETER	1115790
BRACKET, MOUNTING, ACCELEROMETER	1115793
SHIM, TRANSDUCER MOUNTING	1115808
STRAP, RETAINING	700067
TUBE ASSEMBLY, METAL	700090

Drawing Title (cont.)

Drawing No.

TERMINAL STRIP ASSEMBLY

1115383

ACCELEROMETER ASSEMBLY, PIEZOELECTRIC

1115791

2.1.3 ASSEMBLY DRAWINGS

Drawing Title

Drawing No.

INSTRUMENTATION INSTALLATION, PERMANENT-NES DUCT

1114669

INSTRUMENTATION INSTALLATION, TEMPORARY-DESIGN
DEMONSTRATION TEST

1114686

2.1.4 ELECTRICAL DRAWINGS

Drawing Title

Drawing No.

SCHEMATIC DIAGRAM-ELECTRICAL INSTRUMENTATION

1114789

SCHEMATIC DIAGRAM ELECTRICAL INSTRUMENTATION-PERMANENT

1115264

2.2 DOCUMENTS

2.2.1 AGC COMPONENT SPECIFICATIONS

Specification Title

Specification No.

GENERAL COMPONENT SPECIFICATION-TRANSDUCER, VIBRATION

42285

COMPONENT SPECIFICATION-TRANSDUCER-TEMPERATURE
THERMOCOUPLE

42136

42136A

42136A Amend 1

42136B

42136B Amend 1

42136C

42136D

TRANSDUCER-TEMPERATURE, THERMOCOUPLE, SHIELDED,
CHROMEL-ALUMEL

42136/1

42136/1A

<u>Specification Title (cont.)</u>	<u>Specification No.</u>
STRAIN GAGE PRESSURE TRANSDUCER TYPE B	32048/2
STRAIN GAGE PRESSURE TRANSDUCER TYPE 6	32048/6
TRANSMITTER, PRESSURE, STRAIN GAGE, TYPE 6	32048/6A
TRANSDUCER, PRESSURE, DIFFERENTIAL, UNBONDED STRAIN GAGE FOR USE IN RADIATION ENVIRONMENTS, GENERAL SPECIFICATION FOR	90001
TRANSDUCER, PRESSURE, DIFFERENTIAL, UNBONDED STRAIN GAGE FOR USE ON THE NES DUCT SYSTEM	90001/3
THERMOCOUPLES, CONTACT, COPPER/CONSTANTAN, P/N 706614-1, 706615-1, FABRICATION AND INSTALLATION PROCEDURE FOR	90003
TRANSDUCER, VIBRATION, STRAIN GAGE, RADIATION TOLERANT, SPECIFICATION FOR	90010
TRANSDUCER, VIBRATION, STRAIN GAGE, RADIATION TOLERANT, FOR USE ON THE NES DUCT SYSTEM	90010/1
THERMOCOUPLES, RADIATION RESISTANT, GENERAL SPECIFICATION FOR	90012
THERMOCOUPLE, CHROMEL-ALUMEL, 400° TO 2560°R, RADIATION RESISTANT, FOR USE ON NES DUCT ASSEMBLY	20012/3
TRANSDUCER, ONE HALF BRIDGE, STRAIN GAGE, WELDABLE RADIATION RESISTANT, GENERAL SPECIFICATION FOR (U)	90014 Amend 1
TRANSDUCER, ONE HALF BRIDGE, STRAIN GAGE, 240 OHMS, FOR USE ON THE NES DUCT ASSEMBLY (U)	90014/1
SWITCH, LIMIT, PLUNGER ACTUATED, HERMETICALLY SEALED, GENERAL SPECIFICATION FOR (U)	90015 90015 Amend 1
SWITCH, LIMIT, PLUNGER ACTUATED, HERMETICALLY SEALED (U)	90015/1
TRANSDUCER, PRESSURE, ABSOLUTE, BONDED OR UNBONDED, FOR USE ON NRX-A SERIES ASSEMBLIES, GENERAL SPECIFICATION FOR	90019 90019 Amend 1
TRANSDUCER, PRESSURE, SEALED GAGE, UNBONDED STRAIN GAGE, FOR USE ON THE NES DUCT ASSEMBLY	90019/2
CABLE, ELECTRICAL, CERAMIC INSULATED, METAL SHEATHED, RADIATION RESISTANT (U)	90052
CABLE, ELECTRICAL, CERAMIC INSULATED, METAL SHEATHED, RADIATION RESISTANT, FOR USE ON THE NES DUCT	90052/1

2.2.2 AGC MATERIAL AND PROCESS SPECIFICATIONS

<u>Specification Title</u>	<u>Specification No.</u>
RUBBER, SILICONE, WHITE	10846
WIRING AND SOLDERING, PROCEDURE FOR	20030
TUBING AND CAPS, HEAT SHRINKABLE	34228
FABRIC, GLASS, PREIMPREGNATED PHEN RESIN, LAM	44050
WELDING WIRE, ALUMINUM ALLOY	44091
POTTING OF ELECTRICAL CONNECTORS	46003
CLOSURE, PROTECTIVE SELECTION AND HANDLING OF	46017
HARNESS, ELECTRICAL, CONTROL ACCEPTANCE AND INSPECTION	46059
SAFETY WIRING, PROCEDURE FOR	46137
O-RINGS, SEALS, ASSEMBLY AND HANDLING OF	46217
LEVELS OF CLEANLINESS, DESCRIPTION OF	46350
FUSION WELDING	46351
PACKAGING REQUIREMENTS AND PRODUCT ENVIRON.	46387

2.2.3 AGC STANDARDS

<u>Standard Title</u>	<u>Standard No.</u>
CHEMICALS AND MATERIALS, SAMPLING AND TESTING	AGC-STD-3003
CALIBRATION SYSTEMS, REQUIREMENTS FOR	AGC-STD-3008
INSPECTION, PENETRANT	AGC-STD-3010
NATORQ SEALS, INSTALLATION OF	AGC-STD-4002
RIVETS, INSTALLATION OF	AGC-STD-5017
FLUID LINE ASSEMBLIES AND FITTING INSTL	ASD 5040
MARKING, METHODS OF	ASD 5215
IDENTIFICATION PLATES AND MARKERS	ASD 5216
BOLT CIRCLES, TORQUE SEQUENCE PATTERNS	ASD 5226
TUBE, BENDING OF	ASD 5227
TUBE, FLARING OF	ASD 5228

2.2.3 AGC STANDARDS (CONT.)

<u>Standard Title</u>	<u>Standard No.</u>
ADAPTER, FLARED TUBE	AS 1128
NUT, PLAIN, HEXAGON DRILLED, CRES	AS 1187
PIN, STRAIGHT HEADED - CRES	AS 1607
NUT, PLAIN, HEXAGON - BULKHEAD AND UNIVERSAL	AS 4002
CABLE, ELECTRICAL, CERAMIC INSULATED, METAL SHEATHED RADIATION RESISTANT	AS 9702
PLATE - IDENTIFICATION, FOIL TYPE	AS 9703
TAG - IDENTIFICATION, WRAP-AROUND TYPE	AS 9704

2.2.4 MILITARY SPECIFICATIONS

<u>Specification Title</u>	<u>Specification No.</u>
TWINE, IMPREGNATED, LACING AND TYING, FOR USE IN ELECTRICAL AND ELECTRONIC EQUIPMENT	MIL-T-713
STEEL, CORROSION-RESISTING, EXTRA LOW CARBON TYPE 304 PLATE, SHEET AND STRIP	MIL-S-4043
RODS AND WIRE, WELDING, CORROSION AND HEAT RESISTANT ALLOYS	MIL-R-5031
ENVIRONMENTAL TESTING, AERONAUTICAL AND ASSOCIATED EQUIPMENT, GENERAL SPECIFICATION FOR	MIL-E-5272
TUBING, COPPER-SILICONE-MANGANESE, ROUND, SEAMLESS, HYDRAULIC SYSTEMS	MIL-E-6013
STEEL, CORROSION AND HEAT RESISTANT, CHEMICALLY STABILIZED PLATE, SHEET, STRIP	MIL-S-6721
SWITCHES, SENSITIVE AND PUSH, SNAP ACTION, ACTUATORS AND ENCLOSURES, GENERAL SPEC. FOR	MIL-S-6743
WELDING, RESISTANCE, ALUMINUM, MAGNESIUM, NON-HARDENING STEELS OR ALLOYS, NICKEL ALLOYS, HEAT-RESISTING ALLOYS, AND TITANIUM ALLOYS, SPOT AND SEAM	MIL-W-6858
INSULATION TAPE, ELECTRICAL - PRESSURE SENSITIVE ADHESIVE, PLASTIC	MIL-I-7798
BRAZING OF STEELS, COPPER, COPPER ALLOYS AND NICKEL ALLOYS	MIL-B-7883

2.2.4 MILITARY SPECIFICATIONS (CONT.)

<u>Specification Title</u>	<u>Specification No.</u>
WIRING, GUIDED MISSILE, INSTALLATION OF, GENERAL SPECIFICATION FOR	MIL-W-8160
PRIMER COATING, ZINC CHROMATE, LOW-MOISTURE, SENSITIVITY	MIL-P-8585
ANODIC COATINGS, FOR ALUMINUM AND ALUMINUM ALLOYS	MIL-A-8625
ELECTRODES, WELDING, COVERED, LOW AND MEDIUM CARBON STEEL	MIL-E-15599
CORROSION PREVENTIVE COMPOUND, SOLVENT CUTBACK, COLD APPLICATION	MIL-C-16173
ALUMINUM ALLOY ANGLES, CHANNELS I AND Z BEAMS, EXTRUDED OR ROLLED, STRUCTURAL SHAPES	MIL-A-25994
DRAWINGS, ENGINEERING AND ASSOCIATED LISTS	MIL-D-70327

2.2.5 MILITARY STANDARDS

<u>Military Standards</u>	<u>Standard No.</u>
MARKING FOR SHIPMENT AND STORAGE	MIL-STD-129
SPECIFICATIONS AND STANDARDS	MIL-STD-143
ORDER OF PRECEDENCE FOR THE SELECTION OF	
CONNECTOR, PLUG, ELECTRIC, STRAIGHT	MS 3106
SLEEVE, FLARED TUBE FITTING	MS 20819
WIRE, LOCK	MS 20995
INSERT, SCREW THREAD, COURSE AND FINE	MS 21208
NUT, PLAIN, HEXAGON, ELECTRICAL	MS 20341
UNION, FLARED TUBE	MS 24392
TEE, BULKHEAD AND UNIVERSAL FLARED TUBE	MS 24395
NUT, FLARED TUBE, BULKHEAD AND UNIVERSAL FITTING	MS 24400
PIN, COTTER	MS 24665
METALS, DEFINATION OF DISSIMILIAR	MS 33586

2.2.6 FEDERAL SPECIFICATIONS

<u>Specification Title</u>	<u>Specification No.</u>
ALUMINUM ALLOY BARS, ROD, WIRE AND SPECIAL SHAPES	QQ-A-266
ALUMINUM ALLOY BARS, ROD, WIRE, ROLLED, DRAWN OR COLD FINISHED, 2024	QQ-A-268
ALUMINUM ALLOY BARS, RODS, AND SHAPES, EXTRUDED 6063	QQ-A-274
ALUMINUM ALLOY BARS, RODS AND SHAPES, EXTRUDED, 7075	QQ-A-277
ALUMINUM ALLOY BARS, RODS, WIRE AND SPECIAL SHAPES, 7075	QQ-A-282
ALUMINUM ALLOY PLATE AND SHEET 7075	QQ-A-283
ALUMINUM ALLOY BARS, RODS, WIRE, AND SPECIAL SHAPES 6061	QQ-A-325
ALUMINUM ALLOY PLATE AND SHEET, 6061	QQ-A-327
RODS, WELDING, ALUMINUM AND ALUMINUM ALLOYS	QQ-R-566
SOLDER, SILVER	QQ-S-561
ROD, WELDING, COPPER AND NICKEL ALLOY	QQ-S-571
STEEL BARS, CARBON, COLD FINISHED AND HOT ROLLED, GENERAL PURPOSE	QQ-S-633
STEEL, SHEET AND STRIP, LOW CARBON	QQ-S-698
STEEL BARS, SHAPES, AND FORGINGS, CORROSION RESISTANT	QQ-S-763
STEEL PLATE, SHEET, AND STRIP, CORROSION RESISTANT	QQ-S-766

2.2.7 MISCELLANEOUS DOCUMENTS

INSTRUCTION MANUAL FOR CHARGE AMPLIFIER SYSTEM MODEL 039A
INSTRUCTION MANUAL FOR THE "ROLLECTRODE" MODEL MT-809
NES DUCT INSTRUMENTATION KIT BASIC PARTS LIST (TEMPORARY)
NES DUCT INSTRUMENTATION KIT BASIC PARTS LIST (PERMANENT)
NATIONAL BUREAU OF STANDARDS HANDBOOK H-28

3. INSTALLATION DETAILS TABLE OF CONTENTS

Installation procedures will be in four major sub-headings as follows:

Temporary Components - Those components to be completely removed after the Design Demonstration Test (50-PT-901 thru 50-PT-912, and 50-TE-901 thru 50-TE-907).

Reference drawings: AGC-1114686 - Instrumentation Installation
Temporary - Design Demonstration Test
AGC-1114789 - Schematic Diagram - Electrical
Instrumentation

Support Equipment Installation - Those miscellaneous items that are required for support of the instrumentation components: Instrumentation Boom, Support-Quick Coupler-Coded Lug, GN₂ Disconnect Assembly and Tubing.

Reference drawings: AGC-1013625 - Instrumentation Boom
AGC-1114669 - Instrumentation Installation,
Permanent-NES Duct
AGC-1115248 Frame Assembly, Remote Disconnect -
GN₂ Line

Temporary Components - Those components that are to remain installed but electrically disconnected and removed from terminal boxes after the Design Demonstration Test (50-STG-901 thru 50-STG-914 and 50-XVT-901 thru 50-XVT-915).

Reference Drawings: AGC-1114669 - Instrumentation Installation,
Permanent-NES Duct
AGC-1114789 - Schematic Diagram - Electrical
Instrumentation

Permanent Instrumentation Components - Those components that are to remain installed and operative for the duration of the NES Duct Program.

Reference Drawings: AGC-1114669 - Instrumentation Installation,
Permanent-NES Duct.
AGC-1115264 - Schematic Diagram - Electrical
Instrumentation-Permanent

3.1 Temporary Components

- 3.1.1 Pressure Transducers - Strain Gage, Absolute and Gage (50-PT-901 thru 912) Instrumentation Data Log Sheet No. NES 01.

Receiving Inspection Electrical Check

Reference - AGC-1114789, individual calibration sheets. All measurements will be recorded on Instrumentation Data Log Sheets with Quality Control verification. Failure of the transducer to meet the prescribed values shall be cause for rejection. The following measurements will be made at the connector on the transducer: (1) * Pin to Pin

Case to Pin	A	A	B
	B	C	D
	C	C	F
	D	B	E
	E		
	F		

Mounting

Verify the correct location on AGC-1114686 and weld the mounting brackets in place (2) for 50-PT-901, 50-PT-904, 50-PT-905 and 50-PT-906. Bracket provisions for 50-PT-902, 50-PT-903 and 50-PT-907 thru 50-PT-912 are

* Circled numbers refer to the operations to be recorded on the Instrumentation Data Log Sheets.

supplied with the Nozzle and TEC. Install the correct mounting block, transducer, rubber cushion and retaining strap. Lubricate the bolt threads and install the nut, bolt and washer, torque to the value given in the torque table.

Install and route the cable as shown, hold in place with the non-metallic straps and stainless steel braiding at the approximate locations as shown. Where the cable assembly is terminated in a junction box, make the appropriate connections per AGC-1114789 (50-PT-904).

Installation Electrical Check

Reference AGC-1114789.

Repeat the measurements made in Receiving Inspection except the measurements should be made at J-16 and J-21 of the top shield and in terminal box 55B001. This is to be performed only after all the temporary instruments have been installed and the cable harness assembly and cable assembly for 50-PT-904 have been tested for continuity and insulation resistance. Record and verify with Quality Control in the Instrumentation Data Log Sheet (3) . Install tubing identification tags, appropriate fittings, and seals as dictated by AGC-1114686 (4) . Do not torque to final value until the checkout procedure of RN-S-0226 has been performed.

Install lockwire and torque tubing connections to specified values after performance of RN-S-0226 (8) .

NOTE

Do not allow lubricating compound to contaminate the inside of any fitting. Use Neoprene Rubber Gloves to handle Methyl ethyl ketone.

3.1.2 Thermocouples - Immersion - Chromel-Alumel (50-TE-901 thru 903)

Receiving Inspection Electrical Check

Reference - AGC-1114686, AGC-1114789, and individual calibration sheets. Measurements will be recorded on Instrumentation Data Log Sheet NES 02 with Quality Control verification (1). The following measurements will be made:

Resistance between chromel and alumel leads
Resistance between chromel lead and transducer case
Resistance between alumel lead and transducer case

Locate per AGC-1114686 and mount; use appropriate fittings; do not torque to specified value at this time.

NOTE

Tag No.'s 50-TE-902 and 50-TE-903 require special adapters and are connected to branches of harness assembly AGC-1114672.

Connect the conductor leads; attach the #0 Marr connectors and identification tags; weld the shield of the cable to transducer case. Route and secure the cable as dictated on AGC-1114686. Terminate the cable for 50-TE-901 in terminal box 55B015 as shown on AGC-1114789.

With the leads lifted or the connector open, as appropriate, repeat the measurement of resistances performed in the electrical receiving inspection (2).

After performance of RN-S-0226 Instrumentation Checkout Procedure, torque fittings to values specified on AGC-1114686.

3.1.3 Thermocouples Surface Measurement - Chromel-Alumel (50-TE-904 thru 907)

Reference - AGC-1114686, AGC-1114789 and individual calibration sheets. Measurements will be recorded on Instrumentation Data Log Sheet NES 03

with Quality Control verification. The following measurements will be made at the connector on the end of the assembly: ①

Resistance between chromel and alumel leads (Pin A and Pin B)

Resistance between chromel lead and transducer inner shield
(Pin A and Pin C)

Resistance between alumel lead and transducer inner shield
(Pin B and Pin C)

Resistance between inner shield and outer shield (Pin C and outer shield)

Locate per AGC-1114686 and mount; CAUTION, before welding thermocouple flange to the aluminum, route the cable and attach two stainless steel braid straps in position to support the assembly. Form the cable in a manner such that there is no tensile or shear strains on the flange welds when it is welded in place. Weld the flange in place with the Microdot Rollectrode Model MT-809 per vendor's instructions ②. Verify weld mount with Quality Control.

Install thermocouple extension cable assemblies, identification tags and route per AGC-1114686. Make connections at terminal box 55B015 per AGC-1114789. With the leads lifted at the terminal box (55B015), repeat the measurements of the electrical receiving inspection ③ from the appropriate conductors. Complete the installation by making up the connection at the appropriate terminals.

3.2 Support Equipment Installation

3.2.1 Support Quick Coupler Coded Lug (Items 239 thru 248, AGC-1114669). These devices are designed to strap onto various pipes and truss members of the facility and duct structure. The nominal diameters vary from five (5) inches to thirty-six (36) inches. The thirty-six (36) inch straps are for routing cable from the limit switches on the hot and cold water lines to the pipe chase wall. The straps should be mounted as shown on Sheets 4, 5, 6, 13, 14, 15, 16, 17, 20, and 22 of AGC-1114669. The

position of the lugs is adjustable and they should be positioned during installation to accommodate the cable. Cable clamps, selected to accommodate the different cable sizes, are installed on the strap lugs per Sheet 22 of AGC 1114669. These lugs also accommodate AN clamps for routing the GN₂ tubing. It is important that the relative positions of the cables be maintained. The absolute position of any group of cables is not important until the group is in the area of the cable boom. The cables should not cross each other. The lockwiring of the nuts (Item 198) shall be accomplished after the checkout procedures (RN-S-0226) are accomplished. The lockwire shall be looped around one of the cables.

3.2.2 Instrumentation Boom Installation (AGC-1013625)

This part of the procedure references drawing AGC-1013625, Instrumentation Boom, and item numbers are from that drawing unless otherwise noted. The boom is divided into two bridge assemblies, each weighing approximately 200 pounds. (Items 1 and 2). It will be necessary to support these assemblies with a winch or block and tackle arrangement during installation. Item 2 will be attached to a bracket existing on pipe 68-PW-10"-AW at Station 398, as shown on sheet 18 of AGC-1114669.

With the pin (Item 35) removed, position bridge assembly (Item 2) as shown and add shims (Item 19) as required to center the bridge assembly. Insert the pin and cotter pin.

NOTE

Position bridge assembly (Item 1) to mate with Item 2 and connect the two bridge assemblies with pin (Item 17) after lubricating the pin. Use spacers and shims as required to fit.

Connect the other end of bridge assembly (Item 1) to the existing Instrumentation Pass Through Assembly (Reference Aetron drawing 3350-S85) in a similar manner.

At this point the retraction mechanism (Reference Aetron drawing 3350-S82.2) will be checked to insure the boom pivots correctly and stops with sufficient clearance between the Pass Through Assembly and equipment chase wall (1). Record occurrence on Instrumentation Data Log Sheet NES 04.

The bridge assemblies are equipped with small clips to retain cable during the routing steps so that the bundling bar covers (Items 15 and 16) may be left off until all cables are routed.

When routing cable across the boom, a seven (7) inch diameter stress loop should be formed at each hinge point (3 places for each cable). The connector on the end of the metal sheathed cable should not extend beyond 38 inches inside the equipment chase wall.

After all components are installed, a functional check of the boom retraction system shall be performed with the boom carrying the full cable load (2).

3.2.3 Installation of Frame Assembly, Remote Disconnect - GN₂ Line Assembly (P/N AGC-1115248) (Item 187 of AGC-1114669) Record completed installation on Instrumentation Data Log Sheet NES 04 (1).

This assembly is to be installed on the existing Upper Instrumentation Disconnect (Reference Aetron drawing 3350-S82-2) of elevation 3783 on the read duct wall. Position the assembly so that the supply side of the air motors face the Duct Vault rear wall. Mount assembly using hardware specified in Section R-R, sheet 7 of AGC-1114669. Make up tubing connections to the back of the air motor and to the supply side of the disconnect per sheet 7 of AGC-1114669.

NOTE

Line 241-GN-1/4-AS is not installed but is for possible future use. Install cap assembly and seal on the supply side of this line per sheet 7.

Install Upper Truss Disconnect Bracket (Item 188) on existing Upper Truss Instrument disconnect (Reference Air Pre-heater drawing C47351) using hardware specified on sheet 7 of AGC-1114669, Section P-P.

Install flexible metal hose assemblies (Items 249, 250 and 251) between the frame assemblies and the disconnect bracket per detail M, Sheet 7 of AGC-1114669. CAUTION: When torque is applied to flexible hose "B" nut at joint assembly, hold joint assembly fitting with a separate wrench to prevent transmission of torque into joint assembly.

As part of the checkout procedure, a functional check of the disconnect system will be conducted. It should be noted that gaskets MGC54983-4S, -12S and -20S are supplied as an integral part of Assembly 1115248 and are not reusable. After the joint assembly(s) (Items 5, 6 and 7 of AGC-1115248) are tightened to full torque, these gaskets must be replaced upon actuation of the assembly (see Note 21 of AGC-1115248). Additional gaskets are provided as listed in the Basic Parts List but do not appear on the bill of materials of AGC-1114669, since they are not part of the normal installation as performed at NRDS.

Install the tubing as shown on Sheets 4, 5 and 6 of AGC-1114669. These lines run from the Disconnect Bracket to the seal table air motor manifold, the steam line bellows, and the severance plane disconnect respectively. Provisions are made for a 1/4 in. tubing run (line 241-GN-1/4-AS) but it will be installed later only if it is deemed necessary to purge the piezoelectric accelerometer housings.

3.3 Temporary Components to be Electrically Disconnected After Design Demonstration Test

3.3.1 Strain Gage (weldable - half bridge) 50-STG-901 thru 50-STB-914 (AGC-1013630) Instrumentation Data Log Sheet No. NES 05.

Receiving Inspection Electrical Check

Reference - AGC-1114789, individual calibration sheets.

All measurements will be recorded on Instrumentation Data Log Sheets with Quality Control verification. Failure of the transducer to meet the prescribed values shall be cause for rejection. The following measurements will be made at the connector pins of the transducer assembly (1).

Continuity (maximum current not to exceed 50 ma). Pin B to Pin C

B	A
C	F
A	E

Insulation Resistance (with Pins A, B, C, D, E and F tied together) measure between the aggregate and Pin G. (Maximum current 2 ma @ 50 vdc).

Locate and install the strain gage per AGC-1114669. Prior to making the flange weld, form the cable and support it by installing 2 stainless steel braid hold downs as indicated, such that when the flange welds are made, there are no tensile or shear strains on the welds. Weld the flange in place with the Microdot Rollectrode Model MT-809 per vendor's instruction (2). Quality Control to verify the weld. Weld Item 185 in place as shown on Sheet 23 of AGC-1114669 as required (3)*. Clamp the cable as shown on Sheet 22 of AGC-1114669. Route cable along duct in straps per Sheet 22 and in proper slot on the boom per Sheet 19 of AGC-1114669.

Install the cable extension assembly 1013637 and route per Sheet 19 of AGC-1114669.

* This welding may be performed prior to transducer installation, but the location should be verified.

NOTE

50-STG-901 thru 50-STG-909 go to terminal box 55-B-001. 50 STG-910 thru 30 STG-914 go to terminal box 55-B-001 and require extension AGC-1013637-79 (100 ft) 9 required, or to terminal box 51-B-003 and use extension 1013637-39 (35 ft) 5 required. It is recommended but not mandatory that these extensions be bundled in these groups for later removal.

Prior to connection in the terminal box, measure and record the following

④ :

[illegible]

Insulation Resistance (with all leads tied together) measure between the shield and the conductors (maximum current 2 ma @ 50 vdc). Complete the connections to the appropriate terminals per AGC-1114789 and tag the cable with the appropriate channel tag number. These components to remain installed on the duct but electrically disconnected at the conclusion of the Design Demonstration Test. Disconnect the conductors at terminal box 55-B-001 or 51-B-003; pull the flexible cable back to the equipment chase cable trays (see Detail CL, Sheet 19 of AGC-1114669); coil the cables or bundles of cables and stow them in an orderly fashion in the cable tray. Wrap the coils in polyethelene sheet for possible future use (7) .

3.3.2 Vibration Measurement System, Temporary - (Instrument Data Log Sheet NES 06).

3.3.2.1 This system consists of one (1) power supply AGC P/N 3830-63-040, one (1) calibration chassis AGC P/N 3830-63-041 and two (2) amplifier chassis AGC P/N 3830-63-039. These are to be installed in rack 14 of the electronics room per EG&G drawing 101865, revised 7-23-65. The interconnecting cables are supplied and should be connected per AGC-1114798. The system

should be installed and inspected per Section IV of Instruction Manual for Charge Amplifier System Model 039A. Connect the output terminals to terminal box 42B013 per AGC-1114789 (5) .

- 3.3.2.2 Accelerometer (Piezoelectric) - 50-XVT-901 thru 50-XVT-915 (AGC-1115791).
Instrumentation Data Log Sheet No. NES 06.

Receiving Inspection Electrical Check

Reference - AGC-1114789, individual calibration sheets. All measurements will be recorded on Instrumentation Data Log Sheets with Quality Control Verification. Failure of the transducer to meet the prescribed values shall be cause for rejection. The following measurements will be made at the connector end of the transducer assembly (1) :

Center conductor to connector body insulation resistance.

CAUTION: Use 50 vdc megger maximum resistance. Should be parallel combination of cable + 500 meg min.

Center conductor to connector body capacitance. Capacitance should be sum of cable plus 1500 pf max.

Connector pin to outer sheath insulation resistance. Locate and weld the proper accelerometer mounting block per AGC-1114669 (2) *.

Weld clamp Item 183 per Sheet 22 of AGC-1114669 as required in location shown on Sheet 23. Quality Control to verify (3) *. Install the accelerometer on the block with the screws provided; do not lockwire at this time. A functional end-to-end check shall be performed prior to completion of installation. Route the cable as shown on Sheet 19 of

* This welding may be performed prior to transducer installation, but the location should be verified.

AGC-1114669, using the AN cable clamp specified on the drawing to support the cable at the mounting block. Continue routing the cable through Item 183 and on the cable strap attached to the piping per AGC-1114669 and across the cable boom in the proper slot per Sheet 19 of AGC-1114669. Attach the extension lead and route per Sheet 19.

After installation, conduct electrical checks on the coaxial cable at the charge amplifier end as follows, and record (4) :

Insulation resistance center conductor to connector body.
 Capacitance center conductor to connector body.
 Connect the coaxial connector to the proper channel input jack per AGC-1114789.

A functional check of the system will be performed in accordance with RN-S-0226 after which the mounting screws will be lockwired in place.

3.4 Permanent Instrumentation Components

3.4.1 Differential Pressure Transducers (50-FT-54 thru 50-FT-60 and 50-FT-72 thru 50-FT-79) - (AGC-1013634). Instrumentation Data Log Sheet NES 07. Reference: Drawings AGC-1114669, AGC-1115264 and individual calibration sheets.

The transducers will be subjected to a visual and electrical receiving inspection. The electrical inspection will consist of the following measurements:

<u>Insulation Resistance</u>	<u>Continuity</u>
Pin G to Pin A	Pin D to Pin C
B	A B
C	B E
D	C F
E	
F	

The measurements will be recorded and Quality Control verified on Instrument Data Log Sheet No. NES 07 (1) .

Locate and weld on the appropriate transducer mounting block (Items 163 thru 165)* per AGC-1114669. Quality Control to verify the location and welding (2) .

Mount two transducer clamp assemblies (Item 159) with screws provided. Lockwire the screws.

NOTE

Some differential pressure transducers may require spacers to insure drainage of the impulse lines. These are all units which are mounted on horizontal piping runs. The spacers should be installed under the clamp assemblies as indicated by general note 34 of AGC-1114669.

Attach the adapter (Item 161) to the transducer with the screws provided, on each end (see Detail BJ on Sheet 10 of AGC-1114669). Position the transducer in the clamp assembly per Detail BJ of AGC-1114669. Close the clamp assemblies. Route the cable as specified along the truss members and across the cable boom in the proper slot into the equipment chase. The transducer may be positioned as convenient for routing of the cable prior to final torque and lockwiring of the clamp.

In the equipment chase, connect the flexible extension cable assembly 1013637-39 to the transducer assembly junction box 51B003 terminals per AGC-1115264 and G/N 29 and 30 of 1114669.

Prior to connecting to the junction box terminals, repeat the measurements of insulation resistance and continuity as follows:

* This welding may be performed prior to transducer installation, but the location should be verified.

Insulation Resistance

Shield to Red

Black
Green
White
Orange
Blue

Continuity

White to Green

Red to Black
Black to Orange
Green to Blue

Record the values with Quality Control verification on Instrumentation Data Log Sheet ③ .

Complete the installation by connecting the leads to the appropriate terminals per AGC-1115264. These units are permanent but it may not be desirable to bundle the cables permanently until after completion of the checkout procedure per RN-S-0226.

Install the impulse line tubing, fittings, and seals as indicated in the drawing detail of AGC-1114669, insuring that all lines will be drained by gravity after installation ④ . Tag the impulse lines as indicated with the appropriate tag number. Do not torque the fittings to their final value at this time. A functional check of the channel will be performed per RN-S-0226, after which all screws, nuts, and fittings will be torqued to their final value and lockwired.

3.4.2 Sealed Gage Pressure Transducers

3.4.2.1 Cooling Water Pressure Transducers (50-PT-203 thru 50-PT-210 and 50-PT-221 thru 50-PT-226) (AGC-1013633). Instrumentation Data Log Sheet NES 01.

Reference: Drawings AGC-1114669, AGC-1115264 and individual calibration sheets.

The transducers will be subjected to a visual and electrical receiving inspection. The electrical inspection will consist of the following measurements:

Insulation Resistance

Pin G to Pin A
B
C
D
E
F

Continuity

Pin D to Pin C
A B
B E
C F

The measurements will be recorded and verified by Quality Control on Instrumentation Data Log Sheet No. NES 01 (1) .

Locate and weld on the appropriate transducer mounting block (Item 166 or 167)* per AGC-1114669. Quality Control to verify location and welding (2) .

Mount the transducer clamp assembly (Item 160) with the screws provided. Lockwire the screws:

NOTE

The pressure transducers mounted on horizontal pipes will require spacers under the clamps to insure drainage of the impulse lines. The spacers should be installed per G/N 34 of AGC-1114669.

Position the proper transducer in the clamp assembly such that the clamp will close on the end away from the diaphragm. Close the clamp and torque to the bolt to final value as indicated on AGC-1114669. Route the cable as specified on the face of the drawing along the truss members and across the cable boom, in the proper slot, into the equipment chase.

Install the impulse line tubing as indicated in the detail of AGC-1114669 (4) insuring that the line will be drained by gravity after installation. Do not torque the fittings to final value until the checkout procedure of RN-S-0226 is completed. Tag the impulse lines as indicated with the appropriate tag number.

* This welding may be performed prior to transducer installation, but the location should be verified.

In the equipment chase, connect the flexible extension cable assembly (1013637-39) to the transducer assembly and route to terminal box 51-B-003 terminals per AGC-1115264 and G/N 29 and 30 of AGC-1114669.

Prior to connecting to the junction box terminals, repeat the measurements of insulation resistance and continuity as follows:

<u>Insulation Resistance</u>	<u>Continuity</u>
Shield to Red	White to Green
Black	
Green	Red to Black
White	Black to Orange
Orange	Green to Blue
Blue	

Record the values with Quality Control verification in Instrumentation Data Log Sheet (3) .

Complete the installation by connecting the leads to the appropriate terminals per AGC-1115264. These units are permanent but it may not be desirable to bundle the cables permanently until after completion of the checkout procedure per RN-S-0226.

3.4.2.2 Steam Line Pressure Transducer (50-PT-239) (AGC-1013641)

This procedure is identical to the above except that the clamp is mounted to a pair of unistrut brackets, and the entire assembly is in the pipe chase with cable being pulled through conduit to the equipment chase.

Install the flush anchors (Item 229) as specified on Sheet 12 and attach the unistrut brackets (Item 190). Note that one of three unistrut brackets is used to support the cable and two to support the transducer. Attach the clamp assembly to the unistrut brackets and route the cable as shown to terminal box 50-XB-36. Drill 1.015-in. diameter hole in the

box as shown. Install the cable through the box as shown. The swaged fitting is designed to provide a hermetic seal at the box penetration. Install this fitting so that the jam nut supports terminals on the terminal strip as indicated. Pull the cable (Item 258) through conduits defined on AGC-1115264 to terminal box 51-B-003 in the pipe chase. This cable may be pulled prior to transducer installation. Prior to connecting the conductors to the terminals, make the identical electrical checks as on the other pressure transducers and proceed in an identical fashion.

3.4.3 Limit Switch Installation

3.4.3.1 Seal table limit switches (50-IMS-1 thru 50-IMS-4) (AGC-1013626) Instrumentation Data Log Sheet NES 08.

Reference: Drawings AGC-1114669, AGC-1115264, Supplier's Inspection and Test Data Sheets for individual units.

The transducers will be subjected to a visual and electrical receiving inspection. The electrical inspection will consist of the following measurements:

<u>Insulation Resistance</u>	<u>Continuity</u>
Outer Sheath to Pin A	Plunger Free
B	Pin B to Pin C
C	A to C
	A to B
	Plunger Depressed
	Pin A to Pin B
	C to A
	C to B

Record the measured values and verify by Quality Control on Instrumentation Data Log Sheet No. NES 08 (1) .

Locate the switch bracket (Item 174) per Sheet 8. Mount with the hardware provided. Do not lockwire the mounting screws until the functional test of the seal clamp is completed.

Locate and weld the cable clamps (Item 184)* as shown on Sheet 23. Verify weld mount with Quality Control (2) . Route the cable as shown along the seal table and truss members. Route cable across the boom in the slots indicated on Sheet 19 into the equipment chase. Connect the flexible cable assembly (Item 124) to the Limit Switch Assembly. Route and support per Sheet 19 to the junction box on the equipment chase wall. Field splice to the wires indicated on AGC-1115264. Prior to completing the splice, the following measurements are to be made (3) :

<u>Insulation Resistance</u>		<u>Continuity</u>	
Shield to Black		Plunger Free	Plunger Depressed
White		White to Red	Blk to White
Red		Blk to Red	Red to Blk
		Blk to White	Red to White

Complete the installation by making the splices as specified on AGC-1114669.

3.4.3.2 Servance Clamp Limit Switches (50-IMS-9 thru 50-IMS-11) (AGC-1013636)

The transducers will be subjected to a visual and electrical receiving inspection. The electrical inspection will consist of the following measurements:

<u>Insulation Resistance</u>		<u>Continuity</u>	
Shield to Blk		Plunger Free	Plunger Depressed
Red		White to Red	Blk to White
White		Blk to Red	Red to Blk
		Blk to White	Red to White

Record the values and verify with Quality Control on Instrumentation Data Log Sheet No. NES 08 (1) .

* This welding may be performed prior to transducer installation, but the location should be verified.

Locate and mount the switch bracket (Item 179 thru Item 180) per Sheet 21 of AGC-1114669. Do not lockwire the mounting screws until the functional test of the seal clamp is completed.

Install the adapter fittings (Item 254) on both sides of the pipe chase wall as shown on Sheets 11 and 20 of AGC-1114669. Drill the holes in the junction boxes as specified on Sheet 11 of 1114669. Route the cable along the pipes (36-in. water pipes and 20-in. steam pipe) and on the pipe chase/duct valut wall as shown on Sheet 20. Penetrate the pipe chase wall through the conduits as specified on AGC-1115264 and route cable to the appropriate junction box. Install the Swagelok fitting in the same manner as the steam line pressure transducer. Field splice to the wires indicated on AGC-1115264 and AGC-1114669.

- 3.4.4 Weldable Strain Gage Installation (50-STG-4 thru 50-STG-7 and 50-STG-11 thru 50-STG-19) (AGC-1013630). Instrumentation Data Log Sheet NES 05. Reference: Drawings AGC-1114669, AGC-1115264 and individual calibration sheets.

The permanent strain gages are installed in exactly the same manner as the temporary strain gages except they are all terminated at terminal box 51-B-003 per AGC-1115264 and will not be removed after the Design Demonstration Test.

- 3.4.5 Thermocouple Installation

- 3.4.5.1 Pipe Probes (50-TE-57 thru 50-TE-61 and 50-TE-66 thru 50-TE-68) (AGC-1013629) Instrumentation Data Log Sheet NES 09.

Reference: Drawings AGC-1114669, AGC-1115264 and individual calibration sheets.

The transducers will be subjected to a visual and electrical receiving inspection. The electrical inspection will consist of the following measurements:

Resistance

Pin A to Pin B

A C

B C

C Outer Sheath

The measurements will be recorded and verified by Quality Control on Instrumentation Data Log Sheet No. NES 09 (1) .

Locate and install per detail Sheet 10 of AGC-1114669. Do not torque to final value until the functional test of RN-S-0226 is completed. Route cable along pipe and truss members and across the proper slot in the boom into the equipment chase. In the equipment chase, connect the flexible extension cable assembly (AGC-1014636-39) and route per AGC-1114669 to terminal box 51-B-004. Prior to making up the connections, repeat the receiving electrical inspection as follows:

Resistance

Yellow to Red

Yellow to Shield

Red to Shield

Record and verify with Quality Control on the Instrumentation Data Log Sheet. Complete the installation by connecting to the appropriate terminals per AGC-1115264 (2) .

3.4.5.2 Steam Line Pipe Probe (50-TE-159) (AGC-1013635)

Reference: Drawings 1114669, 1115264 and individual calibration sheet. The transducer will be subjected to a visual and electrical receiving inspection, the electrical inspection will consist of the following measurements:

Resistance

Yellow to Red

Yellow to Shield

Red to Shield

Record and verify the measured values with Quality Control on Instrumentation Data Log Sheet No. NES 09 (1). Install the probe in the steam line as shown on Sheet 12 of AGC-1114669. Do not torque the fitting to the final value until after completion of the functional test per RN-S-0226. Route cable as shown on Sheet 12 of AGC-1114669. Drill the hole in the side of the junction box as shown and install the swagelok fitting. Connect the conductors to the terminal strip assembly as shown in Sheet 12 of AGC-1114669. Pull thermocouple extension cable (Item 259) through conduits specified on AGC-1115246 from the pipe chase to the equipment chase terminal box 51-B-004. (This cable may be pulled prior to transducer installation). Prior to making connections in terminal box 51-B-004 make the following electrical measurements:

Resistance

Yellow to Red
Yellow to Shield
Red to Shield

Record and verify with Quality Control the measured values. Complete the installation by connecting to the appropriate terminals per AGC-1115264.

(2)

3.4.5.3 Channel Probes - (50-TE-75 through 50-TE-79 and 50-TE-83 through 50-TE-90 and 50-TE-158 and 50-TE-320) (AGC-1013627)
Instrumentation Data Log Sheet NES 09.

Reference: AGC Drawings 1114669, 1115264 and individual calibration sheets. The receiving inspection and subsequent electrical tests are identical to the previous pipe probe requirements.

The thermocouples are to be installed per G/N 14 of AGC 1114669. Weld mount cable clamps (Item 184), as shown on Sheet 23 of AGC 1114669), in the same manner as the pipe probes. From this point on, installation procedure is identical to that of the pipe probes.

3.4.5.4 Surface Temperature (50-TE-164 through 50-TE-167 (AGC 1013628)
(AGC 1114669, AGC 1115269) Instrumentation Data Log Sheet NES 10

Reference: Drawings AGC 1114669, AGC 1115264 and individual calibration sheets. Receiving inspection and subsequent electrical inspections are identical to that of the pipe probes. Locate per AGC 1114669 and mount;
Caution: Prior to Welding Thermocouple Flange to the Surface Route the First 2 or 3 Feet of Cable and Form the Cable in the Area of the Thermocouple. Attach two stainless steel braid hold down straps as shown on Sheet 10 of AGC 1114669 such that the flange welds are not placed under shear or tensile loads. Weld the flange in place with the Microdot Rollectrode Model MT-809 per vendor's instruction. Verify weld mount with Quality Control (5) .

3.4.6 Accelerometers, Strain Gage (50-XVT-1 through 50-XVT-9) (AGC 1013631)
Instrumentation Data Log Sheet NES 11.

Reference: Drawings AGC 1114669, AGC 1115264, and individual calibration sheets.

CAUTION:

NOTE

These transducers do not have a high tolerance for shock - do not drop, or in any other way impart shock to, these units along any axis.

The transducers will be subjected to a visual and electrical receiving inspection, the electrical inspection will consist of the following measurements:

Insulation Resistance

Pin G to Pin A
Pin G to Pin B
Pin G to Pin C
Pin G to Pin D
Pin G to Pin E
Pin G to Pin F

Continuity

Pin D to Pin C
Pin A to Pin B
Pin B to Pin E
Pin C to Pin F

The measurements will be recorded and Quality Control verified on the Instrumentation Data Log Sheet No. NES 11 (1) .

*Locate and weld on the appropriate transducer mounting block (Items 153, 155 and 158) as shown on Sheet 9 of AGC 1114669.

*Locate and weld mount cable clamps (Item 185) as shown on Sheet 23 of AGC 1114669.

Quality Control to verify location of weld mounted items (2) .

Install the transducers as shown on AGC 1114669 with the screws provided. Do not lockwire the screws until completion of the checkout procedure of RN-S-0226. Route the cable as shown along the duct, truss members and across the cable boom in the correct slot per Sheet 19 of AGC 1114669 to the equipment chase.

The accelerometers will have to be removed from their mountings for an electrical check; do not torque cable clamp nuts to final value since the clamp may have to be removed in order to invert the accelerometer during checkout.

In the equipment chase connect the flexible extension cable assembly 1013637-39 to the transducer assembly and route to terminal box 51-B-003 per AGC 1115264 and G/N 29 and 30 of AGC 1114669.

Prior to connecting to the junction box terminals repeat the measurements of insulation resistance, and continuity as follows:

<u>Insulation Resistance</u>	<u>Continuity</u>
Shield to Red	
Black	White to Green
Green	Red to Black
White	Black to Orange
Orange	Green to Blue
Blue	

* This welding may be performed prior to transducer installation, but the location should be verified.

Record the values with Quality Control verification on the Instrumentation Data Log Sheet ③. Complete the installation by connecting the leads to the appropriate terminals per AGC 1115264. These units are permanent but it may not be desirable to bundle the cables permanently until after completion of the checkout procedure RN-S-0226.

DEFINITIONS

INSTRUMENTATION

All those items required to obtain the measurements delineated in the appropriate measurement requirements list (MRL).

PERMANENT INSTRUMENTATION

Those items supplied to obtain diagnostic and control measurements during the useful life of the duct.

TEMPORARY INSTRUMENTATION

Those additional items supplied, along with the permanent instrumentation, to obtain additional diagnostic measurements during the Design Demonstration Tests (REON Report RN-S-0137) or initial proofing of the duct.

INSTRUMENTATION KIT

A collection of instrumentation items consisting of components, cables, cable assemblies, mounting brackets, mounting hardware and support equipment to include the total quantity required for a specific task.

REQUIRED QUANTITIES

Those quantities required for installation to obtain the measurements listed in the Measurement Requirements List (MRL) in compliance with the appropriate installation drawing list of materials.

SPARES QUANTITIES

Those quantities required for shipment to the test site as insurance or backup for required quantities due to possible damage during shipment handling or installation.

TOTAL QUANTITIES

Required plus spare quantities.

DEFINITIONS, (CONT.)

SURPLUS PARTS

Those parts not useable on the project for which they were initially ordered due to design changes, measurement requirement changes or deletions.