REQUIREMENTS FOR

WELDING AND NONDESTRUCTIVE EXAMINATION

FOR NUCLEAR PRESSURE COMPONENTS

AND NUCLEAR POWER PIPING

NO. 9763-WS-1

PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE

SEABROOK STATION

UNITED ENGINEERS & CONSTRUCTORS INC.

PHILADELPHIA, PENNSYLVANIA

19101

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Rev. 7

UNITED ENGINEERS & CONSTRUCTORS INC.

WS-1
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TABLE OF CONTENTS

IDENTIFICATION OF CHANGES

FOR REVISION 7

This procedure has been revised as listed below for the reasons given:

SECTION	PAGE	REASON
2.3	2	Clarified first paragraph Added SNT-TC-1A edition (1975)
3.1.4.e	4	Incorporated ECA 190219B
3.4.2.1.1	7	Indicated type of filler metal
3.4.2.3 para. 1	7, 8	Changed over temperature range (FCR 119092A); stated maximum time allowed out of oven
3.4.2.3 para. 2	8	Deleted "until consumed" (FCR 110902A)
3.4.2.3 para. 3	8	Changed requirement to suit field conditions (FCR 110902A)
3.4.2.3 para. 5	8	Added to suit field conditions (FCR 110902A)
3.4.3 c) 2)	9	Added "or control number" to suit field conditions (FCR 110902A)
3.4.3 d)	9, 10	Clarified requirement to suit field conditions (FCR 110902A)
3.4.3 f)	10	Changed "electrodes" to "Welding materials and stubs" (FCR 110902A)
3.5.4	13	Added "Peening is not permitted on root or final pass of the Weld"
3.5.4 e)	14, 15	Added requirement that welds "blend in with surrounding metal"; Added new paragraph to establish criteria for ARC induced imperfections caused by GTAW welding process (ECA 100043B)
4.2 a)	19	Added SNT-TC-1A edition (1975)
4.2 b)	19	Added SNT-TC-1A edition (1975)

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UNITED ENGINEERS & CONSTRUCTORS INC.

WS-1

REQUIREMENTS FOR

WELDING AND NONDESTRUCTIVE EXAMINATION

FOR

NUCLEAR PRESSURE COMPONENTS & NUCLEAR POWER PIPING

1.0 SCOPE

This specification covers requirements for welding and nondestructive examination and test methods of nuclear components, including vessels, piping, pumps and valves, as classified in the ASME Boiler and Pressure Vessel Code, Section III, Div. 1, General Requirements, Subsections NB, NC, ND, Classes 1, 2, and 3.

2.0 GENERAL

The equipment specification will reference the applicable code(s) to which the fabrication and testing of the component(s) is to be performed. It will also delineate any deletions of and/or additions to the requirements of this section for the particular component(s) to be fabricated.

The requirements of this specification apply to pressure retaining materials and attachments welded thereto. These requirements also apply to all Seabrook Station specifications where 9763-WS-1 is referenced therein except 9763.006-246-2 and 9763.006-258-3 which associate with Revision 2 of 9763-WS-1.

Requirements which were listed in previous Revisions to 9763-WS-1 that are now covered by other documents are as follows:

Hard Surfacing and Stud Welding	-	ASME Section IX-1977 and Addenda
AWS D1.1	-	ASME Section IX-1977 and Addenda
Ferrite Checks	-	NRC Regulatory Guide 1.31 Revision 3

INFORMATION ONLY

2.1 DEFINITIONS

Nuclear Power Plant Components as used in this specification include appurtenances such as vessels, storage tanks, piping flanges, relief devices, fittings, pumps, and valves.

Welding definitions used in this document are in accordance with AWS Standard A3.0 and Section IX, Appendix I of the ASME Code.

2.2 SYMBOLS

All component drawings which show fabrication by welding shall indicate the joints, together with the required weld joint geometry, welding procedure number, extent and type of inspection in accordance with AWS Standard A2.4.

2.3 CODES AND STANDARDS

The issue of the documents listed below, and in the equipment specification, in effect on the date of purchase order, is applicable when supplying items to this document, except if issue is stated below.

Paragraph Numbers (such as NB-2350) specified herein without a reference are understood to be taken from ASME Code Section III, (Div. 1) Nuclear Power Plant Components.

American Society of Mechanical Engineers (ASME)

Section II, Material Specification Part C - Welding Rods, Electrodes and Filler Metals
Section III, (Div. 1, General Requirements) (Subsections NB, NC and ND), Nuclear Power Plant Components
Section V, Nondestructive Examination
Section IX, Welding Qualifications

American Welding Society (AWS)

A2.4, Symbols of Welding and Nondestructive Testing
A3.0, Definitions - Welding and Cutting

American Society for Nondestructive Testing (ASNT)

SNT-TC-1A-1975, Recommended Practice for Nondestructive Testing Personnel Qualification and Certification

American Society for Testing and Materials (ASTM)

ASTM Standards as referenced in the body of this document.

UE&C Standards

5000-F-1382 (Form No. 4626) - Standard Welding End Preparation Details for Pipe.

3.0 DETAILED REQUIREMENTS

3.1 WELDING QUALIFICATIONS

3.1.1 Personnel and Procedure

Welding procedure qualifications and welder performance qualifications shall be in accordance with ASME Code, Section(s) III, (Div. 1) and IX, Welding Qualifications, and Addenda. In addition to the aforementioned code, the requirements specified herein shall also apply. Welding procedure qualifications(s) shall contain, when required by code, weld current, arc voltage, and tolerances on current and voltage, minimum preheat and maximum interpass temperatures, and travel speed, for each electrode type and welding filler material covered by the specific qualifications. Welding procedures shall be qualified at the minimum preheat temperature. Any essential variables in addition to those presently shown on QW-483 (formerly Q-1) shall be recorded.

3.1.2 Impact Tests

Where charpy impact tests are required, they shall be performed in accordance with Section III, (Div. 1) of the ASME Code.

3.1.3 Qualification for Welding Stainless Steel

Procedure Qualifications for welding of austenitic stainless steel components shall include the following requirements:

3.1.3.1 Control of all austenitic welds to minimize fissuring and sensitization for ASME Class 1, 2, 3 components shall be accomplished as follows.

3.1.3.2 Welding procedures shall include restrictions governing heat input as controlled by voltage, bead width, electrode size, interpass temperature (350°F max.) and travel speed. Weaving with covered electrode shall not exceed three (3) times the electrode core diameter for the manual shielded metal arc process.

3.1.4 Pipe Welding Processes

For all nuclear classes of pipe welding, the following requirements shall apply to the qualified procedures to be used.

a) Backing rings may be used provided they are removed and the I.D. root liquid penetrant or magnetic particle inspected for Class 1 and 2 systems.

b) Permanent backing rings are permitted for Class 3 systems with the approval of the Purchaser.

c) Gas tungsten-arc welding process is required for root pass weld and until 3/16" thickness is deposited. It is optional to weld entire joint cross section with this process.

d) Consumable inserts shall be of the same nominal composition as the bare filler wire.

e) Inert gas root pass purging shall be maintained until 3/16" thickness of weld metal has been deposited. Elimination of inert gas purging is permissible for open root welding of P1 materials only. Purge shall be checked by a gas analyzer or use of a flow chart to insure a 1.0% maximum oxygen atmosphere.

3.2 SPECIAL PROCEDURE QUALIFICATIONS

Whenever contractor's fabrication process and/or the referencing specification section requires dissimilar metal welds, dissimilar weld metal overlay, and/or tube-to-tube sheet welding, a separate procedure and performance qualification shall be required in accordance with the respective subparagraphs which follow.

3.2.1 Dissimilar Metal Welds Qualification

For dissimilar metal welds, procedure and performance qualification shall be accomplished by the rules of the ASME Code(s), Sections III, (Div. 1) and IX.

3.2.2 Dissimilar Weld Metal Overlay Qualification

Qualifications for dissimilar weld metal overlay shall be in accordance with ASME Sections III and IX. The following additional requirements shall also apply:

a) The test assembly shall consist of a duplicate of the production overlay cladding. An eight-inch (8") square shall be the minimum acceptable test assembly for qualification of welders and welder operators.

b) For the cladding chemical analysis, in no case shall the carbon content of the sample exceed .08% C or shall the contents of Cr and Ni be below 18% and 8% respectively when the base material is carbon steel to stainless steel cladding.

c) A 12% maximum iron content shall not be exceeded for Ni-Cr-Fe (F-43) cladding to carbon steel.

d) The chemical analysis for the requirements of subparagraphs b) and c) shall be obtained from the test assembly overlay using material obtained to a depth from the surface of at least 0.020 in. but not greater than the min. cladding thickness to be qualified by the procedure qualification.

3.2.3 Tube-To-Tube Sheet Weld Qualification

Tube-to-tube weld qualifications shall be performed in accordance in Section III Subsections NB-4350, NC-4350, ND-4350 for class 1, 2, or 3 components respectively, and ASME Section IX, except for the following:

The welding equipment used shall have the following features:

a) High frequency arc initiation

b) Current slope control on automatic units

c) Foot operated current slope control for hand held welding torch.

3.2.4 Seal Weld Qualifications

Seal weld qualifications for class 1 and class 2 components shall be performed in accordance with Section III, (Div. 1) and IX. The requirements of NB-4360; NC-4360 shall apply.

3.3 WELDING PROCESSES

General welding shall be performed by one or more of the following processes with butt welds being of multipass construction using filler metal:

a) Manual shielded metal-arc (SMAW)

b) Submerged-arc (SAW)

c) Gas tungsten-arc (GTAW)

d) Gas metal-arc (GMAW) (not acceptable if utilizing the short circuiting or globular mode of transfer for austenitic stainless steel).

e) Other welding processes may be permitted by the Engineer after demonstration of process suitability. Wash pass welding (remelting of cover pass to smooth weld contour) is not permitted.

f) Any process used shall be such that the record required by Section III (Div. 1) of the ASME Code can be made with the exception of the stud welding processes, which shall be restricted to the applications stipulated in the applicable subsections of the subject code.

3.4 FILLER METALS

3.4.1 General Requirements

3.4.1.1 Filler materials shall be supplied with actual reports of chemical and physical tests for each heat and lot number supplied, except physical tests are not required for consumable inserts or stainless steel filler materials. These tests shall be performed on all filler materials as supplied. When welding with the submerged arc welding process physical and chemical test reports shall be supplied for each heat of filler wire and lot of flux combinations. All chemical analyses shall be performed on an undiluted weld deposit.

3.4.1.2 Filler materials shall be in accordance with ASME Section II Part C and as amended by Section III ASME, (Div. 1).

3.4.1.3 The electrode and filler metal supplier shall be required by the purchase order to submit to the contractor, certified copies of the results of all tests required by the order, with or before shipment of the material.

3.4.2 Specific Requirements

3.4.2.1 Stainless Steel Welding Filler Material

3.4.2.1.1 Prior to production usage, the delta ferrite content of test weld deposits from each lot and each heat of weld filler metal procured for the welding of austenitic stainless steel core support structures and Class 1 and 2 components should be verified for each process to be used in production. It is not necessary to make delta ferrite determinations for SFA 5.4 type 16-8-2 weld metal or A-8 filler metal when used for weld metal cladding. Delta ferrite determinations for consumable inserts, electrodes, rod or wire filler metal used with the GTAW process and deposits made with the plasma arc welding process may be predicted from their chemical composition using an applicable constitutional diagram to demonstrate compliance. Delta ferrite verification should be made for all other processes by tests using magnetic measuring devices on undiluted weld deposits. For submerged arc welding processes, the verification tests for each wire and flex combination may be made on a production weld or simulated production weld. All other delta ferrite weld filler verification tests should be made on weld pads that contain undiluted layers of weld metal.

3.4.2.1.2 The weld pad should be examined for ferrite content using a magnetic measuring instrument which has been calibrated against a Magnegage in accordance with AWS A4.2-74. This Magnegage should have been previously calibrated in accordance with AWS A4.2-74 using primary standards as defined therein.

3.4.2.1.3 Weld pad test results showing an average Ferrite Number from 5 to 20 indicate the filler metal is acceptable for Class 1 and 2 austenitic stainless steel components and core support structures.

3.4.2.1.4 A record of all ferrite determination verifications shall be available to the engineer.

3.4.2.2 Gas Tungsten Arc Wire

All bare filler metal rods shall be individually flag-tagged with the alloy number.

3.4.2.3 Coated Electrodes

All low hydrogen type SFA 5.1 and SFA 5.5 coated electrodes shall be received in properly identified, hermetically sealed metal containers, and upon opening shall be maintained in

heated holding ovens at 250°F to 350°F. The maximum time allowed out of the oven is four (4) hours.

All other coated electrodes (stainless steel - CrNi, Inconel-NiCrFe, monel - Ni, etc.) shall be maintained in holding ovens at 150°F to 250°F.

Holding and drying ovens shall be equipped with temperature control indicators which shall be checked against a calibrated temperature measuring device.

The temperature of storage area shall be maintained above 65°F.

Coated electrodes from newly opened containers may be issued directly to the welder for field use.

3.4.2.4 Consumable Insert Material

All consumable inserts shall be identified with the alloy number.

3.4.2.5 Nonconsumable Tungsten Electrode

2% EWTh - AWS A-5.12.

3.4.2.6 Backing Rings

a) Backing strip(s) or ring(s) composition shall conform to the latest revisions of the ASME, or ASTM Standard Specifications. See Para. 3.1.4.

b) Backing strips, rings or spacer blocks, where permitted, shall be of the same P-number category as the base materials for similar weld only. For dissimilar metal welds the higher P-number shall be used. See Para. 3.1.4.

c) Non-metallic or Non-fusing metal retainers shall not be used for welding, however, a standard self-centering nub type temporary backing ring may be used if specified, provided the nubs are removed before the root pass is completed.

3.4.2.7 Submerged Arc Wire and Flux

Submerged arc wire and flux shall meet the requirements of ASME Section II as amended by ASME Section III, (Div. 1) and Section 3.4.1 of this document.

3.4.2.8 Gas Metal Arc Wire (Including Flux Cored)

Gas metal arc wire (including flux cored) shall meet the requirements of ASME Section II as amended by ASME Section III, (Div. 1) and Section 3.4.1 of this document.

3.4.2.9 Welding, Purging and Shielding Gases

Where inert gas is used, the gas shall be welding grade argon, 99.95% purity helium or mixtures thereof.

3.4.3 Filler Metal Handling Requirements

a) The contractor shall submit a plan to the Purchaser, for approval, for the implementation of welding material control which shall cover but not be limited to the provisions listed in Section 3.4 of this document. This plan shall contain a detailed description covering filler metals from its procurement through its final usage.

b) All filler materials, coated electrodes and consumable inserts shall be properly identified to the point of consumption. At no time shall unidentified material or discarded electrode stubs be used.

c) Wire or rod shall be controlled by the use of a weld rod requisition form. Filler materials shall be issued to the welder only upon submission to the storeroom of a filler metal requisition form signed by the welding engineer or welding foreman. The requisition form shall specify:

1) Type of filler material

2) Control number or heat and/or lot number

3) Quantity, size

4) Date and time filler metal is issued

5) Joint number (serial number of item number)

6) Welder's name

7) Signature of welder's immediate supervisor

d) Only one type and control/heat/lot number per size of filler metal shall be issued to a welder at any one time except when a combination of processes (G.T.A.W. &

S.M.A.W.) are required for a joint, then both filler metal types may be issued to the welder. Prior to any new issuance of electrode to a welder, the welder shall have returned all unused previously issued filler metals for restocking or disposal.

e) During periods of inclement weather, electrodes shall be protected from moisture at all times between issuance and use.

f) All unused welding materials and stubs shall be returned to the issuing storeroom for reconditioning or disposal.

3.5 WELDING REQUIREMENTS

3.5.1 Cutting

a) Edge preparation of the base metals shall be accomplished by machining, chipping, and grinding or thermal cutting.

b) Preheating before thermal cutting shall comply with Para. NB-4211, NC-4211, ND-4211.

Finished edges shall be free of irregularities greater in depth than 1/16" in any 1/4" length. Any such irregularities shall be blended into the adjacent surfaces by grinding.

c) Stainless steel and nonferrous material may be thermal cut by the plasma-arc or carbon arc process. Treatment after thermal cutting is discribed below.

Purpose of Cut	Process	Additional Material Removal by Mechanical Means
Weld Joint Preparation and Defect excavation; Subsequent welding of surfaces	Plasma arc	as-cut
	Carbon arc	1/16"
Dimensional cuts; No subsequent welding and surfaces exposed to environment	Plasma arc	grind to bright white metal
	Carbon arc	1/8"

d) Carbon and low alloy steel material may be cut to size and shaped by flame-cutting provided all accumulation of slag and oxide are removed from the cut surface.

3.5.2 Cleaning

a) Grinding shall be limited to resin of rubber bonded aluminum oxide or silicon carbide wheels or carbide burrs. The weld preparation and adjacent base metal surfaces for a minimum of one (1) inch on each side of the weld preparation shall be smooth, clean and free of any foreign matter. Clean stainless and nonferrous parts with acetone, re-distilled isopropyl or ethyl alcohol or approved equal. Cleaning shall be in compliance with UE&C Document MPS-1 and the applicable subsections of the ASME Code Section III (Div. 1).

b) For carbon and low alloy steels, contractor may apply a coating of Special Chemicals Corporation "Deoxaluminate," or Purchaser approved equal, rust preventative coating after cleaning and inspection. Coating shall be applied by brush or spray to produce a dry film thickness of 1.0 mils min. (4.0 mils min. wet film). If any evidence of rusting appears prior to welding, the surface area shall be recleaned. Deoxaluminate may be welded over directly provided it is sound and rust proof.

c) Each pass of an austenitic stainless or nonferrous steel weld shall be cleaned of slag and flux with austenitic stainless steel brushes only. Stainless steel brushes not contaminated by use on any other material shall be used on stainless steel.

d) For other materials, each pass of deposited weld material shall be cleaned using slagging picks, aluminum oxide or silicon carbide grinding wheels bonded with either resin or rubber, or carbon steel wire brushes.

3.5.3 Joint Design

3.5.3.1 Joint design for vessels, components and piping shall be defined in applicable UE&C equipment specification.

3.5.3.2 Joint details for field weld end preparations for piping shall be as shown on UE&C standard drawing titled "Standard Welding End Preparation Details for Pipe", No. 5000-F-1382 (Form No. 4626).

a) Butt Welds

Butt welds shall be made in accordance with the applicable provisions of NB-4000, NC-4000, ND-4000. Component ends shall be prepared for butt welding in accordance with Fig. NB-4233-1, NC-4233-1, ND-4233-1 for classes 1, 2 or 3 components respectively.

The permissible gap or root opening between abutting edges of butt welds and weld grooves for nozzle attachments shall conform to the approved welding procedure.

Use of backing rings shall be in accordance with Section 3.1.4 and 3.4.2.5 of this document.

b) Socket Welds

A marking technique shall be employed for socket welds to verify minimum engagement and gap of 1/16" prior to welding. Pipe ends intended for socket welding shall be free of burrs and chips.

Socket welds shall have a minimum of two weld layers. Austenitic stainless steel socket welds shall employ the GTAW process with filler metal added for at least the root layer. Protective gas back purging is not required.

c) Fillet Welds

Fillet weld dimension and contour shall be in accordance with Figure NB-4427-1, NC-4427-1, ND-4427-1 for classes 1, 2 or 3 components respectively.

d) Tack Welds

All tack welds shall be made in accordance with Para. NB-4231.1, NC-4231.1, ND-4231.1 for classes 1, 2 or 3 components respectively.

e) Temporary Attachment Welds

All temporary welded attachments used for erection purposes shall be made in accordance with NB-4231.2, NC-4231.2, ND-4231.2 for classes 1, 2 or 3 components respectively, and the attachments shall be removed by

mechanical cutting or air-arc burning the attachment for a distance of 1/4" from the metal sufficient to preclude damage. The remainder of the attachment shall be ground flush with the base metal surface. Under no condition are temporary attachments to be removed by hammer blows.

Temporary welds on the base material of the component shall be located where possible on edges and areas that will be trimmed off. Preheating as for other welding shall be required.

f) Permanent Attachment Welds

Permanent attachment welds shall be made in accordance with NB-4430, NC-4430, ND-4430 for classes 1, 2 or components respectively.

g) Stud Welds

Studs on which a full 360° weld fillet is not obtained and where the maximum unwelded fillet does not exceed 25% of the circumference, need not be replaced but shall be repaired by chipping the unfused area to sound material and repair welding. A qualified welding procedure shall be used for welding using the shielded metal arc process with low hydrogen electrodes. Studs on which the unwelded fillet exceeds 25% of the circumference shall be replaced.

h) Tube-to-Tube Sheet Welds

Tube-to-tube sheet welding shall be in accordance with the requirements of Section 3.2.5 of this document.

i) Seal Welds

Seal welding procedures, (for class 1 and class 2 components) personnel employed and examination shall be in accordance with Para. NB-4360, NC-4360, NB-5271, NC-5271.

3.5.4 Weld Appearance

a) Peening

Peening shall be performed only with specific approval of the Purchaser, and if approved shall meet the

requirements of the applicable subsections of the ASME Code, Section III, (Div. 1). Peening is not permitted on the root and final pass of the weld.

b) Surface Finish of Welds

Surface finish of welds shall be in accordance with NB-4424, NC-4424, ND-4424 for classes 1, 2, 3 components respectively. Welds that will be subject to Ultrasonic Inspection where required by the technical section of the Equipment Specification shall have a surface finish of 250 RMS (RHR).

c) Manual Welds

All manual welds shall have a minimum of two layers of weld metal, except that welds attaching name-plates, thin walled tubing, tube-to-tube sheet welding and seal welds etc., may have one layer. Stringer beading is preferred. Weaving with covered electrodes shall not exceed three (3) times the electrode core diameter for stainless steel and five (5) times the electrode core diameter for carbon or low alloy steels. This requirement is to insure good workmanship and not serve as an acceptance criteria. The weave shall be determined through observation of the welding operation and not by physical measurement of the deposited bead.

d) Reinforcement of Welds

Weld reinforcement shall be in accordance with Para. NB-4426, NC-4426, ND-4426 for classes 1, 2 or 3 components respectively.

e) Arc Strikes

Arc strikes shall be removed by grinding. Arc Strikes produced by welding electrodes or magnetic particle inspection shall not be purposely made on base metal surfaces outside of the weld groove area or other areas not to be covered by weld metal. Where inadvertent arc strikes which penetrate the base metal surface occur outside the weld area on the final weld the surface shall be ground to the bottom of the depression to blend in with surrounding metal and liquid penetrant or magnetic particle inspected. If the design material thickness has been violated, repair welding shall be in accordance with Section 3.8 of this document.

ARC induced imperfections on piping caused by the GTAW welding process (coined sparkle) is acceptable with the exception that on branch and circumferential welded joints subject to ultrasonic inservice inspection, the "sparkle" shall be removed within a distance of 2t + 4" or a minimum of 6" whichever is greater by grinding to the bottom of the depression and inspecting the area using liquid penetrant or magnetic particle. If the design material thickness has been violated, repair welding shall be in accordance with Section 3.8 of this document.

f) Uniformity of Welds

Each weld shall be uniform in width and size throughout its full length.

g) Defects

Any cracks, blowholes or other defects that appear on the surface of the weld beads shall be removed by chipping, thermal gouging or grinding before the next covering weld bead is deposited. Stagger all stops and starts. Stops and starts shall be inspected and all defects removed.

h) Suckback

Well rounded depressions are permitted up to a 1/16" depth, provided the width is at least 3 times the depth and the thickness thru the weld is not reduced below the adjacent base metal thickness.

3.5.5 Cladding

3.5.5.1 The thickness of cladding shall be at least 3/16" in the final surface condition unless otherwise specified in the applicable equipment specification.

3.6 DISSIMILAR METAL WELDS

Wherever possible, dissimilar metal welds shall be made in the shop. For welded connections between austenitic stainless steel, Ni-Cr-Fe, nonferrous and others, and carbon/low alloy steel piping and components, welding shall be in accordance with Paragraph 3.3.

3.6.1 Butt Weld Joints

Dissimilar carbon and low alloy steels that require postweld heat treatment (NB-4620, NC-4620, ND-4620) shall be buttered

with Ni-Cr-Fe F No. 43 filler metal and postweld heat treated after buttering. The minimum thickness of the "buttered" area after end preparation shall be 3/8". The joint shall then be welded with Ni-Cr-Fe (F No. 43). The completed joint shall not be postweld heat treated.

3.6.2 Dissimilar butt joints made of carbon/low alloy steels that do not require postweld heat treatment may be welded, without buttering, using type E-309 (F-5) or Ni-Cr-Fe (F-43) filler metal for the entire joint. The carbon or low alloy steel parts shall be preheated in accordance with ASME Section III, (Div. 1), Appendix D. The completed joint shall not be postweld heat treated.

3.6.3 Socket Joints

For dissimilar socket welds, the socket fitting shall be carbon and/or low alloy steel. The GTAW process shall be used with type ER-309 (F-6) for the root layer. Any other process listed in Section 3.3 may be used for remainder of the joint using the same electrode material used for the root layer. Protective gas back purging is not required.

3.7 POSTWELD HEAT TREATMENT AND CONTROL OF PREHEAT AND INTERPASS TEMPERATURES

3.7.1 Preheating techniques and preheat and interpass temperature measurement procedures shall be such as to ensure that the full thickness of the weld joint preparation and adjacent base material is at the specified temperatures as shown in ASME Section III, (Div. 1), Appendix D. When flame heating is used only a neutral flame shall be employed. The heating shall be applied in such a manner as to disperse the heat evenly over an area approximately 6 times the width of the base material thickness. Temperature shall be determined by either surface contact pyrometers, or thermocouples, but not by low melting metallic alloys. Temperature indicating crayons are permitted if they are free from sulfur and halogens.

3.7.2 Low alloy steel welds requiring post-weld heat treatment shall have preheat maintained until post-weld heat treatment is performed.

Postweld heat treatment shall be performed in accordance with the applicable ASME Code, (Div. 1) and UE&C document MPS-1.

3.7.3 Time-temperature recording equipment shall be utilized for all postweld heat treatment. Charts and data sheets shall be

identified as to component(s) processed, dated and signed by Contractor and become part of documentation record provided to Engineer.

3.7.4 All marking fluid and tapes used for temporary marking shall be removed with Purchaser approved solvents prior to thermal treatments.

3.7.5 The contractor shall submit procedures for monitoring preheat on low alloy steels to verify that preheat is being maintained until postweld heat treatment has been performed. Preheat temperatures shall be shown on the weld history records, failure to comply with Para. 3.1 and 3.7.2 as referenced in this specification shall be cause for rejection. However, the rejection may be resolved by verifying soundness of the weld using an acceptable examination method approved by the Construction Manager.

3.8 REPAIR WELDING

3.8.1 Repair of Base Metal Defects

Repair of base metal defects including arc strikes, do not require approval unless the repair exceeds 1/3 of the nominal thickness, or the repairs are made subsequent to any of the conditions noted in the subparagraphs below. Note: The limitation of depth of repair restriction in NB-4131, NC-4131, ND-4131 shall not apply. Listed below are the types of repairs requiring Purchaser's approval, prior to performing repair welding:

1) Repairs following final heat treatment

2) Repairs following final hydrostatic testing

3) Specific approval must be obtained for repairs of cracks or fissures which recur in welds or base material after the third cycle of repair.

4) Repairs of weld end preparations which exceed 1/3 the nominal thickness.

In addition to the above, all defect repairs shall meet the requirements of the applicable subsection of the ASME Code, Section III, (Div. 1).

Note: If description of defect repair cannot be included in the certified materials test report, the same information

required in NB-2539.6, NC-2539.6, ND-2539.6 for classes 1, 2 or 3 components respectively, shall be reported and included with the Weld History Records for all repairs.

3.8.2 Repair of Weld Metal Defects

Unacceptable weld defects detected by the methods required by the applicable subsections of the ASME Code, Section III, (Div. 1), shall be eliminated and repaired. Specific approval must be obtained for repair welds after the third cycle of repair. After the third repair attempt, the joint has not received final acceptance, the weld will be cut out 100% including the heat affected zone and prepared in accordance with Section 3.5 of this document. The joint will then be rewelded in accordance with the requirements of the original welding procedure.

In addition to the above requirements, all repair(s) of weld metal defects shall be performed in accordance with NB-4450, NC-4450, ND-4450.

The contractor who makes a repair weld shall prepare a report which shall include a chart which shows the location and size of the prepared cavity, the welding material identification, the welding procedure, the heat treatment and the examination results of repair welds exceeding in depth the lesser of 3/8" or 10% of the section thickness.

3.8.3 Repaired components, piping or portions of components or piping that have been postweld heat treated within the requirements of the applicable subsections of the ASME Code, Section III, (Div. 1), shall again be postweld heat treated when required by code.

4.0 NONDESTRUCTIVE EXAMINATION AND TEST METHODS

4.1 GENERAL

a) If required, weld end preparations shall be examined by either the liquid penetrant or magnetic particle method prior to welding, in accordance with ASME Section III, paragraphs NB-5130 or NC-5130. Method requirements are contained within paragraphs 4.4 below.

b) The final examination of all welds shall be performed on the final weld surface. Welds not accessible for examination after final assembly shall be examined and accepted prior to final assembly.

c) Written procedures are required for all examination and test methods and shall detail the specific requirements of NB/NC/ND-5112. All written procedures shall be submitted to the Purchaser for review and comment by the NDE group to use.

d) Discontinuities in the weld zone shall be evaluated in accordance with the "Weld Acceptance Standards" of NB/NC/ND-5300. Discontinuities detected in the adjacent base material, during the performance of weld examination, shall be evaluated in accordance with NB/NC/ND-2500, as applicable.

e) The nondestructive examination and test method requirements for Class 3, Tanks and Vessels are contained within paragraph 4.8.

4.2 PERSONNEL QUALIFICATION

a) Personnel performing nondestructive examination under this specification shall be qualified in accordance with the recommended guidelines of SNT-TC-1A-1975 supplements and appendices as applicable for the techniques and methods used. Nondestructive examination shall be the responsibility of personnel certified to Level II or Level III.

b) For nondestructive examination methods not covered by SNT-TC-1A-1975 documents, personnel shall be qualified by the Manufacturer to satisfactory levels of competency by subjection to similar examinations on the particular method involved.

4.3 VISUAL EXAMINATION

a) Visual examination shall be performed in accordance with ASME Boiler and Pressure Vessel Code Section V Article 9. All weld characteristics and surface conditions shall be in accordance with the requirements of NB/NC/ND-4400.

b) The acceptability of fillet welds shall be established by suitable gages or templates. The minimum required size of each fillet weld shall be in accordance with paragraph a) and as specified on applicable drawings and welding procedures.

4.4 LIQUID PENETRANT/MAGNETIC PARTICLE EXAMINATION

4.4.1 Weld surfaces and adjacent base material shall be cleaned and prepared for examination, in accordance with the requirements of Article 6 or Article 7 of ASME Boiler and Pressure Vessel Code Section V, as applicable.

4.4.2 Liquid penetrant examination shall be conducted on non-magnetic material. Magnetic particle examination shall be performed on material that can be magnetized. When part geometry or space restriction prevents magnetic particle examination, liquid penetrant examination may be used.

4.4.3 Liquid penetrant examination shall be performed on non-magnetic material. The method shall be in accordance with the requirements of ASME Boiler and Pressure Vessel Code Section V Article 6.

a) The penetrant materials intended for use shall be of one complete family produced by a single manufacturer and shall be clearly defined by product type and designation within the written procedure as required in paragraph 4.1 c). Intermixing or substitution of materials is prohibited. Materials employed shall be certified by the manufacturer to contain less than one percent total, by weight, of either sulfur or halogens.

b) Abrasive blasting prior to liquid penetrant examination is prohibited.

c) Evaluation of indications and acceptance standards shall be in accordance with NB/NC/ND-5351 and NB/NC/ND-5352.

4.4.4 Magnetic particle examination shall be performed on material that can be magnetized. The method shall be in accordance with the requirements of ASME Boiler and Pressure Vessel Code Section V Article 7.

a) For magnetic particle examination, regardless of the magnetizing technique, the continuous method of examination shall be employed.

b) Evaluation of indications and acceptance standards shall be in accordance with NB/NC/ND-5341 and NB/NC/ND-5342.

4.5 RADIOGRAPHIC EXAMINATIONS

a) Radiographic examination shall be in accordance with the requirements of ASME Section V, Article 2. Acceptance standards shall be in accordance with ASME Section III, paragraphs NB/NC/ND-5320 and NB/NC/ND-5321.

b) Examination of welds shall be performed so as to include coverage of adjacent base material within the density range specified by Article 2, of ASME Code Section V.

c) When 100% radiographic coverage is required and is not possible, a detailed explanation and the proposed alternate NDE examination shall be submitted to the Engineer for review and comment.

d) For other than multi-speed film techniques, a double film technique shall be utilized. The second film shall serve as a comparison radiograph for evaluation of artifacts on relevant indications. Both film shall be included with the applicable documentation for acceptance.

e) The type of radiographic film employed shall be in accordance with ASTM E94-68, Type 1 or 2. The radiographic density shall be in accordance with the requirements of Article 2, ASME Section V.

f) Radiographic examination shall be carried out utilizing a marking system which provides evidence of continuous and complete coverage. Welds shall be radiographed with two (2) or more markers for each film area, except one (1) marker may for be used for pipe 3-1/2" O.D. and smaller.

g) Films shall be identified in a manner which provides positive and permanent traceability. Identification shall include date, manufacturer's name or symbol, item number, joint number, area and other related items. It is desirable that the repair cycle, i.e., R-1, R-2, etc. be part of the identification.

h) Radiographs submitted for review shall be accompanied by a review form and a radiographic technique sheet which identify the approved written procedure. The manufacturer shall certify in writing compliance to the referencing code and shall provide any additional data required for interpretation of the subject radiographs. All documentation as noted above shall meet the minimum requirements of Article 2, ASME Section V.

i) Radiographic review forms shall identify and disposition, acceptable or rejectable, noted discontinuities, weld and adjacent base metal surface conditions, artifacts and other conditions related to the proper evaluation of radiographs.

j) Final, repaired area and in-process radiographs shall accompany shipment of the component where practicable, but in any case, the radiographs shall be on site prior to installation. For field applications, radiographs shall be submitted to the Owner upon completion of fabrication.

4.6 ULTRASONIC EXAMINATION

a) Ultrasonic examination shall be in accordance with ASME Boiler and Pressure Vessel Code Section V, Article 5.

b) Acceptance criteria shall be in accordance with ASME Section III, paragraphs NB/NC/ND-5330.

4.7 OTHER TEST METHODS

a) Any additional test methods shall be performed in accordance with the requirements of paragraphs 4.1 c) and 4.2.

4.8 NONDESTRUCTIVE EXAMINATION AND TEST METHODS - CLASS 3 TANKS AND VESSELS

4.8.1 The radiographic requirements of paragraph 4.5 shall apply except for changes as listed below.

a) When 100% radiography of welds is required, the method shall be in accordance with the requirements of ASME Section V Article 2. Acceptance standards shall be in accordance with ND-5321.

b) When spot radiography of welds is required, the method shall be in accordance with the requirements of ASME Section V, Article 2. Acceptance standards shall be in accordance with ND-5322.

4.8.2 All other requirements of paragraphs 4.1 through 4.7 apply for Class 3 tanks and vessels.

INFORMATION ONLY

INFORMATION ONLY

5.0 INFORMATION TO BE SUBMITTED

5.1 AFTER AWARD

5.1.1 Weld Identification

Contractor shall provide for identification of all welds. The weld identification method employed shall be the basis for reporting all quality aspects.

Weld identification shall be referenced on all weld documentation including nondestructive test records.

5.1.2 Weld Documentation

a) Contractor shall furnish a weld record similar to Fig. No. 1 (attached) covering each shop and field piping weld. Applicable data shall be recorded on the form and signed off by Contractor's Quality Control Engineer. Contractor may use alternate weld document record subject to approval of Purchaser.

b) When liquid penetrant, magnetic particle examination, radiography, and postweld heat treatment is a requirement of the specification or code, the supplier shall attach to the form a certified copy of the laboratory examination report and signed the heat treatment chart record.

5.1.3 Records

Contractor shall maintain records of all information pertinent and traceable to the fabrication and testing of detail material and fabrications. Records shall include the applicable ASME Code Data Report, Weld Documentation, weld procedure and welder performance qualifications, welder identification, current welder qualification status, postweld heat treatment procedures and charts, welding filler material certifications, material certifications, welding repair records, personnel qualifications, nondestructive examination procedures and qualifications, examination and test records, radiographs and weld maps.

Submittal of records shall be in accordance with the referencing specification section or other applicable Quality Assurance document.

FORM 7015
Rev. 1 11/72

united engineers & constructors inc.

FIGURE 1

FABRICATION TRAVELER AND PROCESS CHECK LIST

9763-WS-1

N-STAMP APPLICATIONS

SECTION - A

CLASS I, II, III

JOINT TYPE:

BUTT INSERT _____

BUTT BR _____

OPEN BUTT _____

SOCKETS FILLETS _____

HEAT TREAT REQUIREMENTS:

PREHEAT _____ °F MIN.

INTERPASS _____ °F MAX.

STRESS RELV. _____ °F TEMP. ____ TIME

BASE METAL _____ TYPE INDENT

TO

BASE METAL _____ TYPE INDENT

WELDING PROC. _____

WELD MAP NO. _____

JOINT NO. _____

SYSTEM _____

SPOOL SHEET OR DRAWING NUMBER _____ REV. ____

SPECIFICATION _____

PREPARED BY _____

DATE _____

SECTION - B FABRICATION REQUIREMENTS ITEM NOS.	ACCEPT	REJECT	N A	CONST	QC REP.	DATE	CODE HOLD	CODE CHECK PTS	CODE INSP.
1. MATERIAL IDENTIFICATION: TYPE HT. NO.									
a) INSERT OR BACKING RING									
b) BASE MATERIAL									
c) BASE MATERIAL									
2. FIT UP:									
a) FITTER IDENT									
b) WELD PREPARATION									
c) PRE WELD CLEANLINESS									
d) ALIGNMENT									
e) 1/16" RETRACTION FOR SOCKETS									
f) PRE WELD PURGE ____ CFH									
3. ROOT WELD:									
a) WELDER IDENT									
b) POSITION F V O H									
c) FILLER MATERIAL TYPE-SIZE-HT. NO.									
d) SHIELD GAS FLOW ____ CFH									
e) PREHEAT TEMP. ____ °F INTERPASS ____ °F									
f) METHOD OF MEASUREMENT									
CRAYON ☐ CRAYON ☐									
PYROMETER ☐ PYROMETER ☐									
RECORDER ☐ RECORDER ☐									
g) INSPECTION VT									
MT PT									
RT									
h) DEFECTS OR DEFICIENCIES									
i) RESOLUTION									
4. REMAINDER OF JOINT:									
a) PURGE ____ CFH									
b) SHIELD GAS FLOW ____ CFH									
c) POSITION F V O H									
d) WELDER IDENT									
e) FILLER MATERIAL TYPE-SIZE-HT. NO.									
f) PREHEAT TEMP. ____ °F INTERPASS ____ °F									
g) METHOD OF MEASUREMENT									
CRAYON ☐ CRAYON ☐									
PYROMETER ☐ PYROMETER ☐									
RECORDER ☐ RECORDER ☐									
h) INSPECTION VT									
MT PT									
RT									
UT									
i) DEFECTS OR DEFICIENCIES									
j) RESOLUTION									
5. POST WELD HEAT TREATMENT:									
a) PROCEDURE NO.									
b) METHOD									
INDUCTANCE ☐ TEMP. °F									
RESISTANCE ☐ TEMP. °F									
OTHER ☐ TEMP. °F									
c) METHOD OF MEASUREMENT									
RECORDER ☐ CHART NO.									
PYROMETER ☐									

SECTION - C - DESCRIPTION OF DEFECTS OR DEFICIENCIES LIST BY ITEM NO.

REWORK:

DEFICIENCY REPORT NO.

Q.C. ENGR. DATE AUTHORIZED CODE INSP. DATE

SECTION - D - DISPOSITION ACTION ON DEFICIENCY REPORT NO. VERIFIED AND ITEM REINSPECTED

WELDING SUPERVISOR DATE QUALITY CONTROL ENGR. DATE

SECTION - E - FINAL SIGN OFF

WELD SUPV. DATE Q.C. ENGR. DATE AUTHORIZED CODE INSP. DATE

INFORMATION ONLY

VII. SCOPE OF CERTIFICATION

A. Personnel certified in accordance with this instruction are qualified to perform all visual examinations required during the routine performance of their inspection and/or surveillance assignment.

B. The nature and scope of these visual examinations and applicable acceptance criteria are defined by drawing, specification, code, practice, procedure or other instructions.

C. Personnel certified in accordance with this instruction are qualified to verify, evaluate, and accept or reject visual examination observations.

VIII. RECORDS

A. Complete records of qualifications, tests, ratings and other related data shall be documented and retained in the individual's folder. This data shall be made available for audit or verification by authorized personnel.