500924

X

SPECIFICATION 7100

PRIMARY AND SECONDARY STEEL TANKS

FOR

PROJECT 9S1747

WASTE STORAGE TANKS

200 AREA - BLDG. 241-54F

SAVANNAH RIVER PLANT

E. I. du Pont de Nemours & Co.
Design Division, Engineering Dept.

APPROVED BY:

Atomic Energy Division

9/7/76

Design Division

Engineering Service Division

PREPARED BY:

7/23/76

Design Division

ISSUED BY:

Design Division

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SPECIFICATION NO. 7100

PROJECT 9S1747

PRIMARY AND SECONDARY STEEL TANKS

REVISION APPROVAL SHEET

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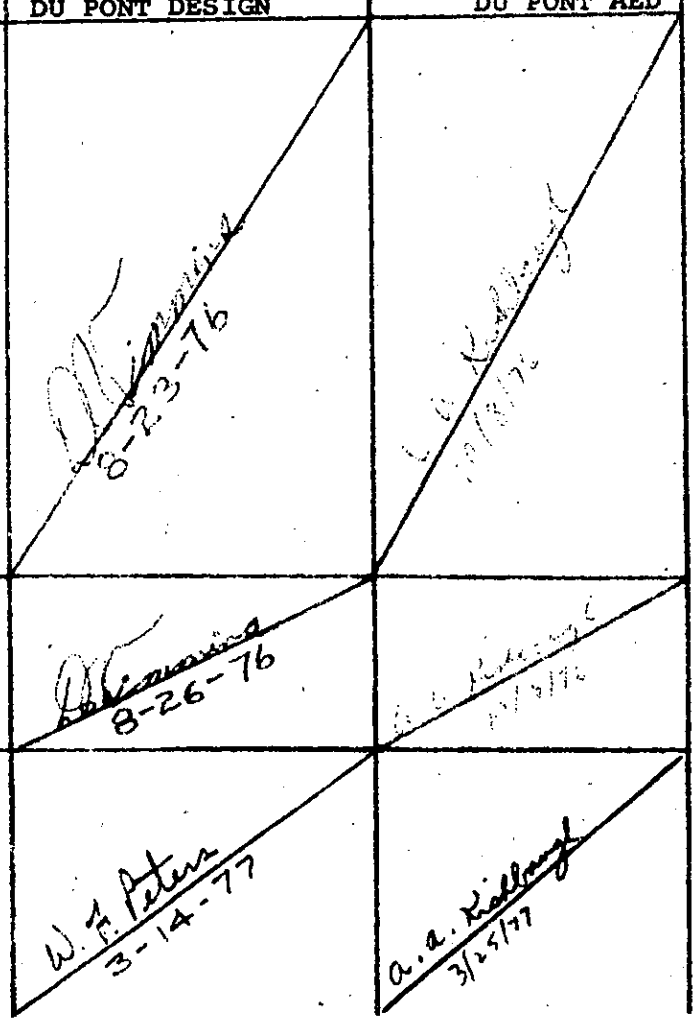
Includes comments from Bidders' Meeting 8/25/76.



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1. GENERAL

1.1. REVISIONS TO SPECIFICATION

1.1.1

REVISIONS TO THIS SPECIFICATION ARE MADE IN TEXT WITH A REVISION NUMBER (EXAMPLE: /4/) NOTED IN THE RIGHT HAND MARGIN. A CHRONOLOGICAL LISTING OF SUPERSEDED DATA, WITH THE DATE OF ITS REVISION, IS ATTACHED FOR RECORD PURPOSES.

1.2. INTENT

1.2.1

THIS SPECIFICATION AND ALL RELATED DRAWINGS DESCRIBES THE EQUIPMENT, MATERIALS OF CONSTRUCTION, FABRICATION AND ERECTION PROCEDURES, STRESS RELIEVING, INSPECTION, AND TESTING REQUIREMENTS FOR THE CONSTRUCTION OF FOUR 85 FT DIAMETER, 1,300,000 GALLON CAPACITY PRIMARY STEEL TANKS, EACH WITHIN A 90 FT DIAMETER SECONDARY STEEL TANK, ALL DESIGNATED AS PART OF BUILDING 241-54F IN THE 200F AREA OF THE SAVANNAH RIVER PLANT. THESE TANKS WILL BE DESIGNATED AS TANKS NUMBERED 44 THROUGH 47.

1.2.2

THE STEEL TANKS COVERED BY THIS SPECIFICATION WILL BE USED FOR THE STORAGE OF HIGH-LEVEL RADIOACTIVE WASTE SOLUTIONS. PREVENTION OF RADIOACTIVE CONTAMINATION AND THE CONTROL OF RADIATION HAZARDS REQUIRES THAT 100% CONTAINMENT INTEGRITY BE MAINTAINED OVER A LONG PERIOD OF TIME. FOR THIS REASON, IT IS IMPERATIVE THAT THESE TANKS BE BUILT WITH HIGHEST REGARD FOR MATERIAL QUALITY, WORKMANSHIP, FABRICATION CONTROL, AND TESTING PROCEDURES WHICH WILL REDUCE TO A MINIMUM ANY POSSIBILITY OF TANK FAILURE OR LEAKAGE WHICH COULD BE ATTRIBUTED TO FABRICATION AND/OR CONSTRUCTION DEFICIENCIES.

1.3. SCOPE

1.3.1

THE SCOPE OF WORK INCLUDED IN THIS SUBCONTRACT CONSISTS OF THE SUPPLY OF MATERIALS, LABOR, AND EQUIPMENT; FOR FABRICATION AND ERECTION; RADIOGRAPHIC EXAMINATION OF WELDS AND INTERPRETATION OF EXPOSED FILMS; AND TESTING FOR CONTAINMENT INTEGRITY OF EACH OF THE PRIMARY STEEL TANKS AND SECONDARY STEEL TANKS.

1.3.2

INCLUDED ALSO IN THIS SUBCONTRACT IS THE SUPPLY OF EQUIPMENT AND THE PERFORMANCE OF ALL WORK NECESSARY TO STRESS RELIEVE EACH OF THE COMPLETELY ERECTED PRIMARY STEEL TANKS.

1.3.3

ALL WORK IS TO BE PERFORMED IN STRICT ACCORDANCE WITH THIS SPECIFICATION AND RELATED DRAWINGS AND IS SUBJECT TO THE TERMS AND CONDITIONS OF THIS SUBCONTRACT.

1.4. APPLICABLE SPECIFICATIONS

1.4.1 /2/

CODES REFERRED TO IN THIS SPECIFICATION ARE TO BE THE LATEST REVISION TO THE DATE OF THIS SPECIFICATION AND ARE PART OF THIS SPECIFICATION AS IF FULLY PRESENTED HEREIN.

1.4.2 /3/

ASME BOILER AND PRESSURE VESSEL CODE SECTION VIII, DIVISION 1, AND SECTION IX SHALL APPLY WITH THE FOLLOWING EXCEPTIONS: CALCULATIONS AND CODE STAMP ARE NOT REQUIRED. QUALITY CONTROL SYSTEM DESCRIPTION PER SECTION VIII, APPENDIX X MUST BE AVAILABLE FOR INSPECTION BY DU PONT. CODE CASE 1586-2 SHALL NOT APPLY.

1.5. APPLICABLE DRAWINGS

1.5.1

THE FOLLOWING IS A LIST OF DRAWINGS APPLICABLE TO THIS SPECIFICATION:

W1626908	TANK BOTTOM LOWERING FRAME
W1626918	TANK BOTTOM LOWERING FRAME
W4499058	DEHUMIDIFICATION SYSTEM
W7003208	SECONDARY LINER PLANS AND DETAILS
W7003218	PRIMARY LINER PLANS AND DETAILS
W7003228	AIR INLET MANIFOLD
W7003238	BASE SLAB REINF.
W7003248	GENERAL ARRANGEMENT
W7003258	LINER PLATE ATTACHMENTS, SH. 1
W7003268	LINER PLATE ATTACHMENTS, SH. 2
W7003398	COOLING SLOTS PLAN AND DETAILS
W7003408	TOP SLAB PLAN
W7003958	PLAN - HEADER SUPPROTS
W7003968	PLAN - COOLING COIL GUIDES
W7003978	PLAN - COOLING COIL SUPPORTS
W7004618	LEAK DETECTION SYSTEM
W7008728	LINER PLATE ATTACHMENTS, SH. 3
W7008878	LINER PLATE ATTACHMENTS, SH. 4
W7009688	TANK BOTTOM LOWERING FRAME, SH. 1
W7009698	TANK BOTTOM LOWERING FRAME, SH. 2
W700107	T.C. PLOT PLAN

W702337 PLOT PLAN
W7004138 EXTERIOR THERMOCOUPLES, SH. 1
W7004148 EXTERIOR THERMOCOUPLES, SH. 2
W7004978 UNDERGROUND THERMOCOUPLES

1.6. DEFINITION OF TERMS

1.6.1

THE TERM **DU PONT** MEANS E.I. DU PONT DE NEMOURS & CO. OR ITS DULY AUTHORIZED REPRESENTATIVE.

1.6.2

E. I. DUPONT DE NEMOURS AND COMPANY IS THE PRIME CONTRACTOR TO THE ENERGY RESEARCH AND DEVELOPMENT ADMINISTRATION AND ALL OTHERS DOING WORK ON THIS PROJECT WILL BE KNOWN AS **SUBCONTRACTORS**.

1.6.3

THE TERM **DU PONT INSPECTOR** MEANS THE DULY AUTHORIZED REPRESENTATIVE OF THE CONSTRUCTION INSPECTION SECTION OF THE DU PONT COMPANY IN CHARGE OF INSPECTING AND APPROVING SHOP WORK PERFORMED UNDER THIS SUBCONTRACT.

1.6.4

THE TERM **DU PONT INSPECTION ENGINEER** MEANS DU PONT'S AUTHORIZED REPRESENTATIVE AT THE SAVANNAH RIVER PLANT IN CHARGE OF INSPECTING AND APPROVING FIELD WORK PERFORMED UNDER THIS SUBCONTRACT.

1.7. CERTIFICATION OF MATERIALS

1.7.1

MATERIALS FOR PLATES, STRUCTURAL SHAPES, AND PIPE SHALL BE CERTIFIED BY MILL TEST REPORTS AS PRESCRIBED BY THE ASTM SPECIFICATIONS APPLICABLE TO EACH MATERIAL (SEE SECTION 2). MILL TEST REPORTS ARE TO BE SUBMITTED TO THE DU PONT INSPECTOR FOR APPROVAL PRIOR TO THE USE OF THE MATERIAL. MILL TEST REPORTS ARE TO BE REVIEWED AND APPROVED BY THE DU PONT INSPECTOR AT THE SUBCONTRACTOR'S SHOP. THE DU PONT INSPECTOR WILL MAKE NECESSARY DISTRIBUTION OF MILL TEST REPORTS INCLUDING TWO COPIES TO THE PROCUREMENT COORDINATOR FOR DESIGN FILE.

1.7.2

ALL PLATES, SUBASSEMBLIES, KNUCKLE PLATES, ETC. SHALL BE INSPECTED BY THE DU PONT INSPECTOR AFTER FABRICATION AND PRIOR TO SHIPMENT TO THE CONSTRUCTION SITE. FOR GENERAL INSPECTION REQUIREMENTS, SEE

ARTICLE VI OF THE GENERAL CONDITIONS.

1.8. OUTLINE OF RESPONSIBLITY

1.8.1

THE SUBCONTRACTOR IS TO PROVIDE ALL LABOR, TOOLS, JIGS, FIXTURES, AND EQUIPMENT FOR THE FABRICATION OF EACH OF THE PRIMARY STEEL TANKS AND SECONDARY STEEL LINER TANKS AS SPECIFIED IN SECTION 3 OF THIS SPECIFICATION.

1.8.2

THE SUBCONTRACTOR IS TO PROVIDE ALL LABOR, TOOLS, DUNNAGE, CRATING, SCAFFOLDING, TEMPORARY SUPPORTS, HANDLING RIGS, LIFTING CRANES, TRANSPORTATION AND ALL OTHER MATERIALS AND EQUIPMENT REQUIRED FOR ALL PHASES OF ERECTION OF THE TANKS AS SPECIFIED IN SECTION 3 OF THIS SPECIFICATION.

1.8.3

THE SUBCONTRACTOR SHALL BE RESPONSIBLE FOR FURNISHING, INSTALLING, AND REMOVING, AFTER INSTALLATION OF THE CONCRETE ROOF, TEMPORARY ROOF SUPPORTS.

1.8.3.1 /26/

THE TEMPORARY ROOF SUPPORTS SHALL BE OF ADEQUATE STRENGTH AND CONFIGURATION TO PERMIT THE HORIZONTAL ROOF PLATES TO BE USED AS THE SUPPORTING FORM FOR PLACING THE CONCRETE ROOF.
(THE MINIMUM DESIGN CAPACITY FOR THE TEMPORARY ROOF SUPPORTS SHALL BE FOR A DEAD PLUS LIVE LOAD OF 800 POUNDS PER SQUARE FOOT.)

1.8.3.2 /4/

WOOD SUPPORTS ARE PREFERRED TO MINIMIZE RISK OF DAMAGE TO TANK PLATES DURING PLACING AND REMOVAL; HOWEVER, METAL SUPPORTS ARE ACCEPTABLE. A TEMPORARY WOOD FLOORING, APPROVED BY DU PONT, WILL BE REQUIRED TO PROTECT THE TANK BOTTOM. THE SUBCONTRACTOR SHALL SUBMIT HIS DESIGN TO DU PONT FOR APPROVAL PRIOR TO FABRICATION.

1.8.3.3 /5/ /27/

VENDOR'S SCHEDULE SHOULD ASSUME 12 WEEKS FOR WORK BY DU PONT CONSTRUCTION FORCES, WHILE

TEMPORARY ROOF SUPPORTS ARE IN PLACE. SHORING MUST BE REMOVED UPON WRITTEN NOTICE FROM DU PONT. WRITTEN NOTICE WILL BE GIVEN AT LEAST ONE MONTH IN ADVANCE OF REQUIRED REMOVAL DATE.

1.8.4

THE SUBCONTRACTOR WILL SUBMIT SIX (6) COPIES OF A DETAILED **CONSTRUCTION SCHEDULE** TO DU PONT WITHIN SIX (6) WEEKS AFTER CONTRACT AWARD. THIS **CONSTRUCTION SCHEDULE** SHALL INCLUDE THE PROCUREMENT, FABRICATION, ERECTION PROCEDURE, ERECTION SEQUENCE, INSPECTION, STRESS RELIEVING AND TESTING OF EACH PRIMARY STEEL TANK AND SECONDARY STEEL LINER TANK ACCORDING TO THE INTENT OF THIS SPECIFICATION. (SEE BID FORMS FOR TARGET CONSTRUCTION SCHEDULE).

1.8.5

THE BIDDER SHALL SUBMIT IN WRITING, ATTACHED TO OR INCLUDED IN HIS QUOTATION, AN AGREEMENT THAT HE IS FULLY AWARE OF RADIOGRAPH REQUIREMENTS, PER PARAGRAPH 4.1.3, AND WILL COMPLY WITH THESE REQUIREMENTS THROUGHOUT THE TERM OF THE SUBCONTRACT.

1.8.6

THE SUBCONTRACTOR IS TO PROVIDE ALL LABOR, EQUIPMENT, INSULATION, CONTROLS, ETC., NECESSARY TO STRESS RELIEVE EACH OF THE ERECTED PRIMARY STEEL TANKS IN ACCORDANCE WITH THE REQUIREMENTS OF THIS SPECIFICATION AS SET FORTH IN SECTION 3.4 - STRESS RELIEVING.

1.8.7

BIDDERS ARE REQUIRED TO SUBMIT WITH THEIR BID AN OUTLINE OF THEIR PROPOSED STRESS RELIEF PROCEDURE AND EVIDENCE OF SUCCESSFUL FIELD STRESS RELIEVING EXPERIENCE ON TANKS OF COMPARABLE SIZE. THE SUBCONTRACTOR IS REQUIRED TO FURNISH NINE (9) COPIES OF A COMPLETE AND DETAILED **STRESS RELIEVING PROCEDURE** (SEE PARAGRAPH 3.4) TO DU PONT FOR APPROVAL 6 MONTHS PRIOR TO USE. THE STRESS RELIEF OPERATION MUST BE WITNESSED IN IT'S ENTIRETY BY DU PONT.

1.8.8

THE SUBCONTRACTOR SHALL BE RESPONSIBLE FOR THE RADIOGRAPHIC EXAMINATION OF WELDS AND THE INTERPRETATION OF THE RADIOGRAPHS FOR WELD INTEGRITY IN ACCORDANCE WITH THE PROCEDURE AS SPECIFIED IN SECTION 4.1.

1.8.9

THE SUBCONTRACTOR SHALL PROVIDE ALL LABOR, EQUIPMENT, AND ALL OTHER ITEMS NECESSARY TO VACUUM LEAK TEST WELDS AS SET FORTH IN SECTION 4.2. VACUUM LEAK TESTING SHALL BE DONE ONLY IN THE PRESENCE OF THE DU PONT INSPECTION ENGINEER.

1.8.10

THE SUBCONTRACTOR SHALL PROVIDE ALL LABOR, PUMPS, HOSES, AND ALL OTHER ITEMS NECESSARY TO PERFORM HYDROSTATIC TESTS OF THE PRIMARY STEEL TANKS AS SET FORTH IN SECTION 4.3.

1.8.11

THE SUBCONTRACTOR SHALL PROVIDE ALL LABOR, MATERIALS, EQUIPMENT, ETC., NECESSARY TO INSTALL THE INSULATING LAYER BETWEEN THE BOTTOM OF THE SECONDARY STEEL LINER TANKS AND BOTTOM OF THE PRIMARY STEEL TANKS.

1.8.12 /25/

THE SUBCONTRACTOR WILL BE RESPONSIBLE FOR PERFORMING ALL OPERATIONS IN CONNECTION WITH RAISING AND LOWERING THE TANK BOTTOM AND KNUCKLE FOR ALL PRIMARY STEEL TANKS AND SECONDARY STEEL LINERS. HE SHALL SUBMIT TO DU PONT FOR APPROVAL, INCLUDED IN "CONSTRUCTION SCHEDULE" PER PARAGRAPH 1.8.4, HIS PROPOSED METHOD FOR RAISING, SHORING, LOWERING, AND MAKING FINAL ALIGNMENT OF BOTH PRIMARY AND SECONDARY BOTTOMS AND KNUCKLE ASSEMBLIES, AND FOR PROTECTING THE INSULATING LAYER DURING THESE OPERATIONS.

1.8.13

DU PONT WILL SUPPLY AT THE CONSTRUCTION SITE THE NECESSARY LIFTING FRAMES FOR THE SUBCONTRACTOR'S USE.

1.8.13.1

HYDRAULIC SYSTEMS, FOR EACH FRAME CONSIST OF 4 HANNIFIN MODEL HJ2N JACKS, 8 INCH BORE X 48 INCH STROKE (MANUFACTURER'S DESIGN CAPACITY 1500 PSI) WHICH WILL BE CHECKED AND FURNISHED IN GOOD OPERATING CONDITION BY DU PONT. HYDRAULIC PUMPS, TOGETHER WITH PIPING WITH CAPACITY FOR THE WORK INTENDED (1500 PSI MIN.), WILL BE FURNISHED BY DU PONT. HYDRAULIC JACKS AND HYDRAULIC SYSTEMS WILL BE DELIVERED WITH THE UNASSEMBLED RAISING-LOWERING FRAMES TO A STORAGE SITE IN THE VICINITY OF THE TANK WORKING AREA. THE SUBCONTRACTOR SHALL ASSEMBLE AND CHECK THE FRAMES

AND COMPLETE HYDRAULIC SYSTEMS FOR STRENGTH, CAPACITY, ADEQUACY FOR THE PURPOSE AND CONDITION, AND SHALL BE RESPONSIBLE FOR THEIR USE AND MAINTENANCE IN ALL OPERATIONS DURING ERECTION, RAISING, LOWERING, AND DISMANTLING.

1.8.13.2

UPON COMPLETION OF THE WORK, THE SUBCONTRACTOR SHALL REMOVE THE FRAMES AND HYDRAULIC EQUIPMENT TO THE DESIGNATED STORAGE SITE, IN THE SAME CONDITION AS RECEIVED, LESS NORMAL WEAR AND TEAR.

1.8.14

ALL ELECTRIC FACILITIES REQUIRED IN THE PERFORMANCE OF THE WORK SPECIFIED IN THIS CONTRACT SHALL BE SUPPLIED BY THE SUBCONTRACTOR.

1.9. GENERAL DRAWING REQUIREMENTS /6/

1.9.1

THE SUBCONTRACTOR SHALL SUBMIT TO DU PONT ONE MONTH PRIOR TO FABRICATION, COMPLETE DRAWING DETAILS; AND WELDING PROCEDURE QUALIFICATION TESTS IN ACCORDANCE WITH SECTION IX OF THE ASME BOILER AND PRESSURE VESSEL CODE COVERING ALL SHELL CLOSURE WELDS, STRUCTURAL WELDS AND FILLET WELDS.

1.9.2

THE SUBCONTRACTOR SHALL SUBMIT TO DU PONT FOR APPROVAL DETAILED SHOP DRAWINGS OF ALL COMPONENT PARTS OF THE PRIMARY AND SECONDARY STEEL TANKS INCLUDING ALL ATTACHMENTS TO THE TANKS COVERED BY THIS CONTRACT. UPON REQUEST TO DU PONT AND AFTER SUITABLE CHANGES BY DU PONT HAVE BEEN MADE, DU PONT DRAWINGS MAY BE USED AS PART OF THE SUBCONTRACTOR'S APPROVAL DRAWINGS. REPRODUCIBLE COPIES WILL BE SUPPLIED BY DU PONT WITHOUT CHARGE.

1.9.3

THE SUBCONTRACTOR SHALL SUBMIT TO DU PONT FOR APPROVAL COMPLETE FIELD ERECTION DRAWINGS DETAILING THE EXACT LOCATION AND LAYOUT OF ALL TANK WELD SEAMS. THE LOCATION OF A VERTICAL WELD SEAM NEAR THE NORTH POINT ON EACH TANK SHALL BE USED AS A REFERENCE FOR LOCATING ALL WELDS. ANY OFFSET OF THESE BASE POINTS SHALL BE ESTABLISHED WITH LINEAR DIMENSIONS.

1.9.4

SUBCONTRACTOR'S DRAWINGS WILL BE CHECKED FOR GENER

DIMENSIONS AND MATERIAL SPECIFICATIONS ONLY. DRAWINGS WILL BE RETURNED MARKED **APPROVED**, **APPROVED AS NOTED**, OR **NOT APPROVED - RESUBMIT FOR APPROVAL** WITHIN 15 WORKING DAYS AFTER RECEIPT. DRAWINGS MARDED **APPROVED** OR **APPROVED AS NOTED** WILL RELEASE THE VENDOR FOR FABRICATION. ONE SEPIA OR 16 PRINTS OF **APPROVED** ANC CORRECTED **APPROVED AS NOTED** DRAWINGS MUST BE RETURNED TO DU PONT TWO (2) MONTHS PRIOR TO FIELD ERECTION FOR DU PONT DISTRIBUTION.

1.9.5 ITEMS THAT ARE SPECIFIED TO HAVE DU PONT APPROVAL SHOULD BE MAILED IN QUADRUPLICATE UNLESS OTHERWISE SPECIFIED TO:

E. I. DU PONT DE NEMOURS CO., INC.
PROCUREMENT COORDINATOR
DESIGN DIVISION, ATOMIC ENGRG. SECTION
ENGINEERING DEPT. LOUVIERS 43N23
WILMINGTON, DELAWARE 19898

EACH DOCUMENT SHALL CONTAIN THE DU PONT PROJECT NUMBER 9S1747; THE DU PONT ORDER NUMBER, AXC 908W; AND THE APPLICABLE TANK NUMBER.

2. METERIAL SPECIFICATIONS
2.1 MATERIAL SPECIFICATIONS
2.1.1 /8/ /30/

STEEL PLATE FOR CONSTRUCTION OF THE SECONDARY TANKS SHALL BE ASTM A516, GRADE 70 AS ROLLED. STEEL PLATE FOR CONSTRUCTION OF THE PRIMARY TANKS SHALL BE ASTM A537, CLASS 1, COMMERCIAL QUALITY GRIT BLASTED AT THE STEEL MILL OR AT THE SUBCONTRACTOR'S SHOP. GRIT BLASTING OF ROOF PLATES IS NOT REQUIRED IF CLEANED AFTER STRESS RELIEVING PER PARAGRAPH 3.5. MILL TEST REPORTS ARE REQUIRED FOR ALL STEEL PLATES PER SECTION 1.7 OF THIS SPECIFICATION. FOR NORMALIZED STEEL, ASTM A537, CLASS 1, SUPPLEMENTARY REQUIREMENT S6, DROP WEIGHT TEST IS TO BE MADE FOR EACH MILL PLATE 5/8" THICK AND OVER. TEST IS TO BE MADE AT -10 DEG. F AND FAILURE IS CAUSE FOR REJECTION. PLATES UNDER 5/8" THICK SHALL BE TESTED IN ACCORDANCE WITH SUPPLEMENTRY REQUIREMENT S5 CHARPY V-NOTCH, APPLIED TRANSVERSE TO PLATE ROLLING DIRECTION. TEST IS TO BE MADE AT -10 DEG. F AND IMPACT RESULTS UNDER 15 FT-LBS SHALL BE CAUSE FOR REJECTION.

2.1.2

STEEL FOR TEMPORARY ATTACHMENTS, CLIPS, ETC., SHALL BE ASTM A36 OR A DU PONT APPROVED EQUAL. WELDING TEMPORARY ATTACHMENTS OF GALVANIZED STEEL WILL NOT BE PERMITTED.

2.1.3

STEEL PLATE FOR ROOF RISERS AND OTHER PERMANENT PLATE ATTACHMENTS SHALL BE ASTM A36 OR A DUPONT APPROVED EQUAL. MILL TEST REPORTS ARE REQUIRED PER SECTION 1.7.

2.1.3.1

ALL STEEL PLATE ATTACHMENTS TO THE PRIMARY TANK, BELOW THE LIQUID LEVEL, SHALL BE OF THE SAME MATERIAL AS THE PRIMARY TANK.

2.1.4

STEEL PIPE FOR INLETS AND COOLING COIL RISERS WILL BE FABRICATED AND PROVIDED BY DU PONT AND INSTALLED BY THE SUBCONTRACTOR.

2.1.5

STRUCTURAL STEEL SHAPES SHALL BE ASTM A36.

2.1.6

ELECTRODES AND FILLER WIRE (AWS DESIGNATIONS) SHALL BE IN ACCORDANCE WITH THE PROVISIONS OF SECTION 3.2.

2.1.7

ROOF PLATE ANCHOR STUDS ON PRIMARY LINER TANKS AS SHOWN ON APPROVED DRAWINGS ARE TO BE BY THE NELSON STUD WELDING DIVISION OF GREGORY INDUSTRIES, INC. OR A DUPONT APPROVED EQUAL.

3. FABRICATION AND ERECTION

3.1. FABRICATION AND ERECTION

3.1.1

SHOP FABRICATION TO FORM SUBASSEMBLIES MAY BE MADE AT THE OPTION OF THE SUBCONTRACTOR.

3.1.1.1

DU PONT REFERENCE DRAWINGS SHOW REQUIRED PLATE THICKNESS. SUBCONTRACTOR MAY VARY PLATE SIZES TO MINIMIZE FIELD WELDING. PLATE THICKNESS CANNOT BE LESS THAN THAT SHOWN ON DU PONT DRAWINGS.

3.1.2

THE SUBCONTRACTOR WILL BE RESPONSIBLE FOR ESTABLISHING WELD SHRINKAGE ALLOWANCES WHICH WILL RESULT IN COMPLETED VESSELS WITHIN THE TOLERANCES SPECIFIED.

3.1.3

THE SUBCONTRACTOR WILL BE RESPONSIBLE FOR ESTABLISHING MATERIAL CONTROL AND HANDLING PROCEDURES WHICH MINIMIZE THE POSSIBILITY OF MECHANICAL DAMAGE TO PLATES AND KNUCKLES AND INSURE ONLY THE USE OF APPROVED MATERIALS IN THE FABRICATION OF THE TANKS AND LINERS. PRACTICES USED IN HANDLING PLATES OR SUBASSEMBLIES SHALL BE SUCH AS TO PREVENT STRESSING BEYOND THE YIELD POINT.

3.1.4

DIMENSIONAL TOLERANCES SHOWN ON APPROVED SHOP DRAWINGS SHALL BE MAINTAINED. DEVIATION FROM THE NOMINAL DIAMETER OF THE TANK AS SHOWN ON APPROVED SHOP DRAWINGS SHALL BE LIMITED TO PLUS OR MINUS TWO (2) INCHES. DEVIATION FROM THE TRUE CIRCLE SHALL NOT EXCEED ONE (1) INCH IN EIGHTY (80) INCH ARC LENGTH. THE KNUCKLE RADIUS OF THE TANK BETWEEN THE BOTTOM AND THE SIDE WALL IS TO CONSIST OF TWELVE (12) OR LESS SUBASSEMBLIES OF INDIVIDUAL KNUCKLE PLATES. THE KNUCKLE PLATES SHALL BE CAREFULLY CURVED IN TWO DIRECTIONS BY FORMING TO THE RADII SHOWN ON THE DRAWINGS. THE KNUCKLE PLATES MAY BE FORMED BY HOT OR COLD FORMING. THE METHOD SELECTED SHALL BE STATED IN BID. DEFORMATION IN CURVATURE SHALL BE CONTROLLED SO THAT THE DEVIATION ON THE HORIZONTAL CIRCUMFERENCE IN A TWO (2) FOOT LONG ARC SHALL NOT EXCEED 5/16" AS FORMED AND BEFORE WELDING TO OTHER SECTIONS. THESE TOLERANCES SHALL APPLY TO BOTH SECONDARY AND PRIMARY STEEL TANKS.

3.1.5 /9/

THE TANK BOTTOMS SHALL BE FLATTENED AFTER LOWERING AND PRIOR TO TRIMMING SO THAT THE MAXIMUM HEIGHT OF ANY DISTORTION SHALL NOT EXCEED 3''. THE MAXIMUM SLOPE ON ANY DISTORTION SHALL NOT EXCEED 0.33 INCHES PER FOOT. THE FLATNESS TOLERANCE APPLIES TO ANY AREA ON THE TANK BOTTOM (WITHIN THE KNUCKLE RADIUS LIMITS) IN THE POST HEAT TREAT CONDITION. THE PROPER FLATNESS TOLERANCE IS TO BE ACHIEVED BY ANY APPROPRIATE MEANS EXCLUDING THE USE OF SLEDGE HAMMERS OR EQUIVALENT. ANY FLATTENING OPERATIONS SHALL BE APPLIED PRIOR TO THE STRESS RELIEVING OPERATION. NO FLATTENING WILL BE ALLOWED AFTER STRESS RELIEVING.

3.1.6 /10/ /28/

ONLY THOSE OPENINGS IN THE TANKS WHICH APPEAR ON THE APPROVED SHOP DRAWINGS WILL BE PERMITTED. NO HOLES OR TEMPORARY ACCESS OPENINGS SHALL BE CUT IN THE STEEL TANK PLATES BELOW THE TANK ROOF PLATES. PLATE SECTIONS ABOVE THE KNUCKLE PLATES MAY BE TEMPORARILY LEFT OUT TO SERVE AS ACCESS DOORS PROVIDED THEY ARE WELDED IN PLACE PRIOR TO STRESS RELIEVING. ALL WELDING ON THE PRIMARY TANK BELOW THE PRIMARY ROOF PLATES SHALL BE COMPLETE BEFORE STRESS RELIEVING.

3.1.7 /20/

SHARP GOUGES, DEEP SCRATCHES, OR ANY OTHER SURFACE BLEMISHES ON THE INNER SURFACE OF THE PRIMARY AND SECONDARY TANK WALLS OR BOTTOM, CAUSED DURING MILL PRODUCTION, FABRICATION, OR ERECTION SHALL BE REPAIRED AS FOLLOWS:

1. SURFACE BLEMISHES LESS THAN 1/32'' IN DEPTH SHALL BE DISREGARDED.

2. SURFACE BLEMISHES GREATER THAN 1/32'' IN DEPTH SHALL BE FEATHERED OUT BY GRINDING. NO WELD REPAIR IS REQUIRED IF: (1) THE DEPTH AFTER GRINDING DOES NOT EXCEED 1/16'', AND (2) ANY SINGLE AREA NOT MEETING THE MINIMUM THICKNESS SET BY ASTM A20 DOES NOT EXCEED NINE SQUARE INCHES OR SIX INCHES IN LENGTH. IF THIS LIMITATION IS EXCEEDED, REPAIR PER ITEM 3 BELOW. NOTE: IF VISUAL INSPECTION INDICATES DOUBT AS TO THE COMPLETE REMOVAL OF THE BLEMISH, DYE PENETRANT TESTING SHOULD BE USED.

2A. ISOLATED BLEMISHES, SUCH SCALE DEPRESSIONS FROM PLATE ROLLING, MAY BE LEFT UNGROUND IF: THEY ARE SMOOTHLY CONTOURED, THERE ARE NOT

MORE THAN TWO IN ANY NINE SQUARE INCHES, NO DEPTH EXCEEDS 1/16-INCH, AND THEY DO NOT EXCEED 1/2-INCH IN SIZE.

/32/

3. SURFACE BLEMISHES OF DEPTHS GREATER THAN 1/16" AFTER GRINDING SHALL BE REPAIRED BY BUILDING UP WITH WELD MATERIAL TO OBTAIN SPECIFIED THICKNESS AFTER GRINDING. WELD REPAIRED AREAS SHALL BE GROUND SMOOTH AND DYE PENETRANT TESTED.

4. ALL DEFECTS ARE TO BE REPAIRED AT THE STEEL MILL OR AT THE VENDOR'S SHOP, EXCEPT FOR HANDLING MARKS WHICH CAN BE REPAIRED IN THE FIELD BEFORE STRESS RELIEVING.

THE SUBCONTRACTOR SHALL PROVIDE PROTECTION TO COMPLETED PORTIONS OF THE PRIMARY AND SECONDARY STEEL TANKS TO AVOID DAMAGE INSOFAR AS POSSIBLE. ON THE PRIMARY TANK, SURFACE OF PLATES CONTAINING MILL STENCIL MARKINGS SHALL BE PLACED ON THE EXTERIOR SIDE OF THE TANK. AT THE SUBCONTRACTOR'S OPTION, THE PRIMARY TANK BOTTOM PLATES MAY BE PLACED WITH MILL STENCIL MARKS UP, PROVIDED THEY ARE GROUND SMOOTH AND REPAIRED AS SPECIFIED ABOVE.

3.1.8

THE EDGES OF PLATES MAY BE PREPARED BY MACHINING, SHEARING, GRINDING, OR MECHANICALLY GUIDED GAS CUTTING, EXCEPT THAT IRREGULAR EDGES MAY BE PREPARED BY MANUALLY GUIDED GAS CUTTING.

3.1.9

ALL WELDS JOINING THE PRIMARY AND SECONDARY STEEL TANK WALL, BOTTOM, COLUMN, AND KNUCKLE PLATES SHALL BE BUTT WELDS CONFORMING TO THE REQUIREMENTS OF SECTION VIII OF THE ASME BOILER AND PRESSURE VESSEL CODE, SUBSECTION B, PART UW, FOR 100% JOINT EFFICIENCY (TABLE UW-12 NO. 1).

3.1.10

CLIPS, LUGS, ETC., WELDED TO THE TANKS FOR PURPOSES OF PLATE ALIGNMENT, HANDLING, WELD MACHINE GROUNDING, ETC., SHALL BE WELDED TO THE EXTERIOR SURFACES OF THE TANKS EXCEPT WHERE HANDLING AND FABRICATION REQUIREMENTS MAKE THIS IMPOSSIBLE. ALL SUCH ATTACHMENTS SHALL BE REMOVED FROM THE PRIMARY TANK SURFACES PRIOR TO STRESS RELIEVING BY CHIPPING, GRINDING OR BURNING. ANY GROOVES RESULTING FROM THE REMOVAL OF SUCH ATTACHMENTS SHALL BE FILLED

WITH WELD METAL AND GROUND SMOOTH PRIOR TO INSPECTION.

3.1.11

VERTICAL SEAMS OF ADJACENT SHELL COURSES SHALL BE OFFSET CIRCUMFERENTIALLY FROM EACH OTHER. THE POSITIONING OF WELDS SHALL BE SUCH THAT NO MORE THAN THREE TANK PLATES MEET AT ANY ONE WELD JUNCTURE REGARDLESS OF THE LOCATION ON THE TANK.

3.1.12

THE MAXIMUM PERMISSIBLE OFFSET BETWEEN PLATES OF EQUAL THICKNESS TO BE JOINED BY WELDING SHALL NOT EXCEED TEN PERCENT OF THE PLATE THICKNESS.

3.1.13

FULL PENETRATION WELDS SHALL BE MADE ON THE TANK BOTTOM; PERMANENT BACKUP STRIPS SHALL NOT BE USED. THE JOINT MAKEUP AND WELDING PROCEDURE SHALL BE IN ACCORDANCE WITH APPROVED PROCEDURES AND DETAILS. WELDS ON HORIZONTAL ROOF PLATES MAY BE MADE FROM ONE SIDE ONLY WITH BACKUP STRIPS. IN THIS CASE, BACKUP STRIPS NEED NOT BE REMOVED.

3.1.14

ALL PLATES SHALL BE LAID OUT AND JOINED BY WELDING USING A SEQUENCE THAT WILL PROVIDE MINIMUM DISTORTION AND BUCKLING OF THE PLATES, AND FOR THE BOTTOM PLATE AND KNUCKLE RADIUS ASSEMBLY INSURE MINIMUM VARIATION IN SLOPE AND/OR ELEVATION AS SPECIFIED. THE WELD SEQUENCES ARE TO BE INCLUDED IN THE TANK DETAIL DRAWINGS TO BE SUBMITTED TO DU PONT FOR APPROVAL PRIOR TO STARTING ANY FABRICATION.

3.1.15

PRIOR TO FIT UP FOR WELDING, ALL EDGES ARE TO BE THOROUGHLY CLEANED SO AS TO BE FREE OF DIRT, OIL, WATER, SCALE, SURFACE OXIDES OR ANY OTHER CONTAMINATING MATERIAL WHICH WOULD TEND TO LOWER THE QUALITY OF THE FINISHED WELD. SANDBLASTING TO CLEAN THE WELDING GROOVE PRIOR TO WELDING OR TO CLEAN THE SURFACE OF A LAYER OF WELD METAL PRIOR TO DEPOSITION OF A SUBSEQUENT LAYER IS PERMISSIBLE. WHERE MOISTURE IS VISIBLE OR SUSPECTED ON SURFACE OF METAL IN WELD GROOVE, METAL SHALL BE HEATED TO A MINIMUM OF 300 DEGREES F PRIOR TO WELDING TO REMOVE ALL SUCH MOISTURE.

3.1.16

THE METHOD FOR WELDING TANK BOTTOM PLATES SUPPORTED ON CRIBBING

MUST HAVE DU PONT'S APPROVAL BEFORE STARTING. TANK BOTTOM FLATNESS TOLERANCES SPECIFIED MUST BE MET.

3.1.17

PRECAUTIONS SHALL BE TAKEN BY THE SUBCONTRACTOR NOT TO DAMAGE THE CONCRETE BASE SLAB OR THE INSULATING LAYER DURING CONSTRUCTION OF THE STEEL TANKS.

3.2. WELDING

3.2.1

EACH WELDING PROCEDURE SHALL BE QUALIFIED IN ACCORDANCE WITH SECTION IX OF THE ASME BOILER AND PRESSURE VESSEL CODE. THE PROCEDURE SPECIFICATION SHOULD FOLLOW FORM QW-482 IN SECTION IX. ANY CHANGES IN ESSENTIAL VARIABLES OF THE PROCEDURE AS EXPLAINED IN PARAGRAPH QW-250 OF SECTION IX WILL REQUIRE REQUALIFICATION OF THE PROCEDURE.

3.2.2

ALL TANK WELDING COVERED BY THIS SPECIFICATION SHALL BE PERFORMED ONLY BY WELDING OPERATORS WHO HAVE BEEN QUALIFIED IN ACCORDANCE WITH SECTION IX, PARAGRAPH QW-300 OF THE ASME BOILER AND PRESSURE VESSEL CODE. ANY CHANGE IN ESSENTIAL VARIABLES AS EXPLAINED IN PARAGRAPH QW-350 OF SECTION IX WILL REQUIRE REQUALIFICATION OF THE WELDER OR WELDING OPERATOR.

3.2.2.1

TANK ERECTION WELDERS SHALL BE QUALIFIED AT THE ERECTION SITE BY THE SUBCONTRACTOR. THE QUALIFICATION TESTS WILL BE WITNESSED BY DU PONT AT THE SITE FOR COMPLIANCE WITH ASME CODE REQUIREMENTS.

3.2.2.2

QUALIFICATION TEST RESULTS OF SHOP WELDERS WHO WILL BE WORKING ON TANK SUBASSEMBLIES WHICH WILL BE SENT TO THE ERECTION SITE WILL BE WITNESSED BY A DU PONT INSPECTOR FOR COMPLIANCE WITH ASME CODE REQUIREMENTS.

3.2.2.3

RECORDS OF PROCEDURE QUALIFICATION TESTS AND QUALIFICATION TESTS FOR WELDERS AND WELDING

OPERATORS SHALL BE RECORDED BY THE SUBCONTRACTOR ON FORMS WHICH INCLUDE ALL OF THE INFORMATION SET FORTH IN FORM QW-482, QW-483 AND QW-484 OF SECTION IX. PROCEDURE QUALIFICATIONS SHALL BE SUBMITTED TO DU PONT AT THE TIME THE TANK DRAWINGS ARE SUBMITTED FOR APPROVAL.

3.2.3

EACH WELDER SHALL BE ASSIGNED AN IDENTIFICATION NUMBER BY THE SUBCONTRACTOR. THIS IDENTIFICATION NUMBER IS TO BE RECORDED ON THE QUALIFICATION TEST FORM FOR EACH WELDER. WELDS MADE BY EACH WELDER SHALL BE IDENTIFIED AS DESCRIBED BELOW OR BY METHOD APPROVED BY DU PONT. THE IDENTIFICATION NUMBER IS TO BE PLACED ADJACENT TO ALL WELDS MADE BY THE WELDER. WELDER IDENTIFICATION MARKS SHALL BE MADE WITH MARKING CRAYONS ONLY. THE IDENTIFICATION NUMBER FOR MANUAL WELDS SHALL APPEAR AT THREE FOOT INTERVALS: FOR SUBMERGED-ARC WELDS, THE INTERVAL SHALL BE APPROXIMATELY 10 FEET.

3.2.4

THE AUTOMATIC SUBMERGED METAL ARC METHOD IS TO BE USED IN THE FABRICATION OF THE TANKS WHEREVER POSSIBLE. VERTICAL SEAMS AND OTHER SEAMS WHICH CANNOT BE WELDED BY THE AUTOMATIC SUBMERGED ARC METHOD MAY BE WELDED BY THE SHIELDED METAL-ARC METHOD USING COATED ELECTRODES. ANY OTHER WELDING METHOD MAY BE USED PROVIDED IT PASSES PROCEDURE QUALIFICATION TESTS AND RECEIVES DU PONT APPROVAL.

3.2.5

WELDS TO BE RADIOGRAPHED ARE TO BE OF THE QUALITY REQUIRED BY ARTICLE I-5 OF SECTION VIII, DIVISION 2, OF THE ASME BOILER AND PRESSURE VESSEL CODE. SUPPLEMENTARY REQUIREMENTS COVERING SURFACE CONDITION AND SPECIAL INSTRUCTIONS REGARDING BACKING STRIPS, ELONGATED POROSITY, AND SLAG INCLUSIONS ARE LISTED IN PARAGRAPH 4.1.18.

3.2.6

FILLER WIRE FOR SUBMERGED ARC WELDING AND COVERED ELECTRODES SHALL BE IN ACCORDANCE WITH THE SPECIFICATIONS SET FORTH IN THE QUALIFIED WELDING PROCEDURES. TENSILE STRENGTH OF DEPOSITED WELD METAL SHALL NOT BE LESS THAN THAT OF THE PLATE MATERIAL. ONLY APPROVED ELECTRODES AND FILLER WIRE WILL BE PERMITTED ON THE JOB SITE. SUITABLE STORAGE FACILITIES SHALL BE PROVIDED BY THE SUBCONTRACTOR.

3.2.7

THE FLUX USED FOR SUBMERGED ARC WELDING SHALL CONFORM TO THE SPECIFICATIONS SET FORTH IN THE QUALIFIED WELDING PROCEDURE.

3.2.8

WELDING SHALL NOT BE DONE WHEN THE TEMPERATURE OF THE BASE METAL IS LESS THAN 0 DEGREES F, WHEN SURFACES ARE WET, NOR DURING PERIODS OF HIGH WINDS, UNLESS THE OPERATOR AND THE WORK ARE PROPERLY PROTECTED. WHEN THE AIR TEMPERATURE IS BETWEEN 32 DEGREES F AND 0 DEGREES F, THE SURFACE WITHIN 3 INCHES OF THE WELD SHALL BE HEATED TO ABOVE 60 DEGREES F BEFORE WELDING.

3.2.9

ALL JOINTS IN THE TANK ARE TO BE OF THE FULL PENETRATION TYPE. BACK CHIPPING WHERE REQUIRED SHALL BE SPECIFIED IN THE QUALIFIED WELDING PROCEDURE. NO PERMANENT BACKING STRIPS ARE PERMITTED EXCEPT ON ROOF PLATES. A CONSUMABLE INSERT RING, EITHER EB OR FLAT RING TYPE, MUST BE EMPLOYED FOR THE FINAL WELD ON THE SECONDARY CAPITAL SECTION. THE WELDING PROCEDURE MUST SPECIFY THE MAXIMUM ROOT GAP ALLOWED.

3.2.10

EACH LAYER OF WELD DEPOSIT ON MULTI-PASS WELD SEAMS IS TO BE CLEANED OF SLAG AND OTHER DEPOSITS BEFORE THE APPLICATION OF SUBSEQUENT LAYERS.

3.2.11

ARC STRIKES FROM WELDING ELECTRODES OR **ARCAIR** ELECTRODES WILL NOT BE PERMITTED ON PLATE SURFACES ADJACENT TO WELDS. WHERE ARC STRIKES OCCUR INADVERTENTLY, THEY SHALL BE REMOVED BY GRINDING AND THE LOCATIONS CHECKED FOR CRACKS AS SPECIFIED IN SECTION 4.4. WHERE DEPTH OF GRINDING EXCEEDS 1/16**, THE DEPRESSION SHALL BE FILLED WITH WELD METAL AND GROUND SMOOTH. UNFILLED ARC CRATERS SHALL BE GROUND AND INSPECTED AS SET FORTH ABOVE FOR ARC STRIKES.

3.2.12

REQUIREMENTS FOR NONDESTRUCTIVE TESTING ARE GIVEN IN SECTION 4 - INSPECTION AND TESTING.

3.3. INSULATING LAYER

3.3.1

THE SUBCONTRACTOR SHALL SUPPLY AND INSTALL AN INSULATING LAYER

BETWEEN THE SECONDARY AND THE PRIMARY TANK BOTTOMS. THE TOP SURFACE OF THE INSULATION WILL HAVE SLOTS EITHER FORMED OR CUT AFTER PLACING REFRACTORY. BIDDER SHALL STATE HIS PROPOSED MATERIAL AND THICKNESS OF REFRACTORY AS PART OF BIDDER'S PROPOSAL.

3.3.2

THE MATERIAL USED SHALL HAVE INSULATING PROPERTIES SUCH THAT THE TEMPERATURE AT ANY PLACE ON THE TOP SURFACE OF THE BASE SLAB SHALL NOT EXCEED 300 DEGREES F DURING THE STRESS RELIEF OPERATION. THE MATERIAL SHALL BE OF A CHEMICAL COMPOSITION SUCH THAT THE MATERIAL WILL NOT ACT AS A CORROSIVE AGENT AGAINST THE TANK BOTTOM DURING THE CONSTRUCTION PERIOD WHEN THE MATERIAL IS EXPOSED TO THE WEATHER. THE PROPOSED MATERIAL AND INSTALLATION PROCEDURE SHALL BE APPROVED BY CU PONT PRIOR TO USE. TEST DATA OF THE REFRACTORY SHALL BE SUBMITTED BY THE SUBCONTRACTOR AS PART OF THIS PROCEDURE. THE TOP SURFACE OF THE REFRACTORY SHALL BE SMOOTH WITHIN 1/2" OF A TRUE PLANE.

3.3.3

THE MATERIAL RECOMMENDED SHALL HAVE A MINIMUM COMPRESSIVE STRENGTH OF 300 PSI AFTER THE TANK STRESS RELIEF OPERATION. THIS COMPRESSIVE STRENGTH SHALL BE VERIFIED AS FOLLOWS:

3.3.3.1 TESTING BY SUBCONTRACTOR

1. THREE CYLINDERS SHALL BE CAST IN THE MORNING AND THREE IN THE AFTERNOON OF EACH DAY'S POUR. A MINIMUM OF 24 CYLINDERS SHALL BE CAST.

2. THE CYLINDERS SHALL BE TAKEN IN STANDARD 6" DIAMETER BY 12" LONG TUBES.

3. ALL CYLINDERS SHALL BE AIR DRIED ON THE JOB SITE FOR A MINIMUM OF 48 HOURS.

4. THE CYLINDERS SHALL THEN BE DELIVERED TO THE TESTING LAB. WEIGHED TO DETERMINE DENSITY, OVEN DRIED AT 230 DEGREES F FOR 24 HOURS, AND WEIGHED AGAIN TO DETERMINE DRY DENSITY.

5. AFTER REMOVAL FROM OVEN, CYLINDERS WILL BE CAPPED AND CRUSHED.

6. THE COLD CRUSHING STRENGTH OF EACH OF THE THREE CYLINDER GROUPINGS MENTIONED IN ITEM 1 WILL BE NUMERICALLY AVERAGED. THE AVERAGED COLD CRUSHING STRENGTH FOR EACH GROUPING SHALL NOT BE LESS THAN

380 PSI.

3.3.3.2 TESTING BY DU PONT

1. FINAL ACCEPTANCE OF REFACTORY INSTALLATION WILL BE BASED ON CORED SAMPLES TAKEN AND TESTED BY DU PONT.

2. CORES SHALL BE TAKEN A MINIMUM OF 24 HOURS AFTER REFRACTORY INSTALLATION.

3. SIX CORES SHALL BE TAKEN IN THE AREA OF EACH DAY'S POUR - 2 IN REFRACTORY MATERIAL PLACED DURING THE MORNING, 2 IN MATERIAL PLACED AT MID DAY, AND 2 IN MATERIAL PLACED DURING THE AFTERNOON.

4. ALL CORED SAMPLES SHALL BE AIR DRIED FOR 24 HOURS AND THEN OVEN DRIED AT EITHER 230 DEGREES F FOR 24 HOURS OR 1100 DEGREES F FOR 1 HOUR, /11/ PRIOR TO TESTING.

5. THE MINIMUM COLD CRUSHING STRENGTH OF ANY CORE SHALL NOT BE LESS THAN 380 PSI FOR SAMPLES CURED AT 230 DEGREES F AND 250 PSI FOR SAMPLES CURED AT 1100 DEGREES F. /12/ /29/

6. DESIGN SHALL BE NOTIFIED OF ANY CORE FAILING TO MEET THIS MINIMUM. IN THIS CASE, DESIGN WILL EITHER APPROVE THE TEST RESULTS OR WILL REQUIRE ADDTITIONAL CORE SAMPLES TAKEN IN THE SAME LOCATION. THESE CORES WOULD BE TAKEN IN SUFFICIENT NUMBER TO DETERMINE WHETHER THE FAILURE IS THE RESULT OF A FAULTY SAMPLE, DAMAGED WHILE BEING CORED, OR THE RESULT OF UNACCEPTABLE REFRACTORY.

7. THE RESULTS OF ALL CORE SAMPLES SHALL BE TRANSMITTED TO THE PROJECT'S A&C SPECIALIST ENGINEER AND MADE AVAILABLE TO THE TANK SUBCONTRACTOR.

3.3.3.3

COMPRESSIVE STRENGTH VALUES LISTED THROUGHOUT SECTION 3.3.3 MAY BE REVISED, AND TEST PROCEDURES MODIFIED, DEPENDING ON THE MATERIAL SUBMITTED FOR APPROVAL PER PARAGRAPH 3.3.2.

3.4. STRESS RELIEVING

3.4.1

AFTER THE COMPLETION OF ALL WELDING, CUTTING, BURNING AND OTHER

HIGH TEMPERATURE WORK. THE PRIMARY STEEL TANKS COVERED BY THIS SPECIFICATION ARE TO BE STRESS RELIEVED AT 1100 DEGREES F. AS FOLLOWS:

3.4.1.1 /23/

ABOVE 600 DEGREES F. THE RATE OF HEATING SHALL NOT BE MORE THAN 100 DEGREES F. PER HOUR. DURING THE HEATING PERIOD THE DIFFERENCE BETWEEN THE HIGHEST AND THE LOWEST TEMPERATURES ON THE TANK SHALL NOT EXCEED 200 DEGREES F. IN ADDITION, ANY TWO THERMOCOUPLES 15 FEET APART OR LESS SHALL NOT SHOW A TEMPERATURE DIFFERENTIAL GREATER THAN 125 DEGREES F.

3.4.1.2 /13/

THE PRIMARY TANK SHALL BE HELD AT OR ABOVE 1100 DEGREES F FOR NOT LESS THAN ONE HOUR. DURING THE HOLDING PERIOD THE DIFFERENCE BETWEEN THE HIGHEST AND THE LOWEST TEMPERATURES ON THE TANK SHALL NOT EXCEED 150 DEGREES F. IN ADDITION, ANY TWO THERMOCOUPLES 15' APART OR LESS SHALL NOT SHOW A TEMPERATURE DIFFERENTIAL GREATER THAN 125 DEGREES F.

3.4.1.3

DURING THE HEATING AND HOLDING PERIODS, THE PRIMARY TANK ATMOSPHERE SHALL BE SO CONTROLLED AS TO AVOID EXCESSIVE OXIDATION OF THE SURFACE OF THE PRIMARY TANK. HEATERS SHALL BE OF SUCH DESIGN AS TO PREVENT DIRECT IMPINGEMENT OF FLAME ON THE TANK.

3.4.1.4

ABOVE 600 DEGREES F, COOLING SHALL BE DONE AT A RATE NOT GREATER THAN 125 DEGREES F PER HOUR. DURING THE COOLING PERIOD THE DIFFERENCE BETWEEN THE HIGHEST AND LOWEST TEMPERATURES THROUGHOUT THE PRIMARY TANK SHALL NOT EXCEED 200 DEGREES F.

THE SPECIFIC PROCEDURE TO BE FOLLOWED SHALL BE THE APPROVED ''STRESS RELIEVING PROCEDURE'' PREVIOUSLY SUBMITTED BY THE SUBCONTRACTOR AS PER PARAGRAPH 1.8.7.

3.4.2

THE DETAILED **STRESS RELIEVING PROCEDURE** SHOULD CONTAIN THE FOLLOWING DETAILED INFORMATION:

3.4.2.1

STEP BY STEP PROCEDURAL INSTRUCTIONS.

3.4.2.2

DETAILS OF TEMPORARY SUPPORTS, COVERS, INSULATION, ETC., REQUIRED FOR MINIMIZING DEFORMATION OF THE TANKS AND LIMITING TEMPERATURE GRADIENTS IN THE VESSEL, AND PROCEDURES FOR REMOVING THESE MATERIALS AFTER THE STRESS RELIEF OPERATION IS COMPLETE.

3.4.2.3

THE NUMBER, LOCATION AND MEANS OF PLACING THERMOCOUPLES ON THE TANK. THERMOCOUPLES SHALL BE INSTALLED IN SUFFICIENT NUMBER ON OUTSIDE (ONLY) SURFACES OF THE TANK TO DETECT UNDERHEATING AND LOCAL OVERHEATING AND TO INSURE UNIFORM HEAT DISTRIBUTION, SO FAR AS POSSIBLE, THROUGHOUT THE STRESS RELIEF OPERATION.

3.4.2.4

THE EXACT TIME-TEMPERATURE RELATIONSHIP WHICH IS TO BE FOLLOWED OVER THE ENTIRE DURATION OF THE STRESS RELIEF OPERATION, SHOWING MAXIMUM AND MINIMUM HEAT-UP AND COOL-DOWN RATES; MAXIMUM THERMAL GRADIENTS WHICH WILL BE PERMITTED TO OCCUR BETWEEN ANY TWO POINTS IN THE TANK METAL; AND THE STRESS RELIEF TEMPERATURE AND HOLDING TIME AT THIS TEMPERATURE.

3.4.2.5

METHOD OF INTRODUCING HEAT TO THE TANK FOR THE STRESS RELIEF OPERATION, INCLUDING NUMBER AND TYPE OF BURNERS (OR OTHER DEVICES) TO BE USED, PLACEMENT OF BURNERS, TYPE OF FUEL, DESCRIPTION OF BURNER CONTROLS, THE MEANS OF PROTECTING THE TANK AGAINST LOCAL OVERHEATING, SAFETY PROTECTION AND BACK-UP CONTROLS.

3.4.2.6

METHOD OF PREVENTING DISTORTION SUCH AS WARPAGE OR SAGGING DURING THE HIGH HEAT AT THE STRESS RELIEVING OPERATION WHEN THE YIELD STRENGTH OF

THE STEEL WILL BE REDUCED. 3.4.3

THE SUBCONTRACTOR IS TO SUPPLY ACCURATELY CALIBRATED EQUIPMENT FOR CONTINUOUSLY RECORDING THE TIME-TEMPERATURE RELATIONSHIP WHICH OCCURS DURING THE STRESS RELIEF OPERATION. THE CAPACITY OF THE RECORDING EQUIPMENT MUST BE SUFFICIENT TO ACCOMMODATE THE THERMOCOUPLE SETS PLACED IN THE BASE CONCRETE SLAB. THE SUBCONTRACTOR WILL BE RESPONSIBLE FOR PLACING SUFFICIENT THERMOCOUPLES TO RECORD THE TEMPERATURES AT TOP OF STRUCTURAL BASE SLAB TO INSURE THAT THIS SLAB DOES NOT EXCEED 300 DEGREES F. THERMOCOUPLES AND WIRING FOR STRUCTURAL BASE SLAB TEMPERATURE MEASUREMENTS WILL BE SUPPLIED AND INSTALLED BY THE SUBCONTRACTOR. THERMOWELLS WILL BE INSTALLED BY DU PONT.

3.4.4

THE SUBCONTRACTOR SHALL NOTIFY DU PONT IN WRITING WHEN EACH TANK IS READY FOR STRESS RELIEVING. THE STRESS RELIEF NOTIFICATION MUST CERTIFY THAT ALL WELDING AND THERMAL CUTTING WORK ON THE TANK IS COMPLETE AND THAT THE TANKS MEET THE TOLERANCES SPECIFIED ON APPROVED SHOP DRAWINGS AND THE CONDITIONS AND INTENT OF THIS SPECIFICATION.

3.4.5 /14/

UPON RECEIPT OF A STRESS RELIEF NOTIFICATION, THE SUBCONTRACTOR AND AUTHORIZED REPRESENTATIVES DESIGNATED BY DU PONT WILL MAKE A JOINT INSPECTION OF THE TANK. DEFECTS, DISCREPANCIES, OMISSIONS, ETC., REVEALED IN THIS INSPECTION SHALL BE CORRECTED AS REQUESTED BY DU PONT REPRESENTATIVES. EQUIPMENT SHALL BE PROVIDED BY THE SUBCONTRACTOR, SUCH AS SCAFFOLDING ON WHEELS, TO INSPECT ALL AREAS OF THE TANK FROM A DISTANCE NOT GREATER THAN 2-1/2 FEET.

3.4.6

UPON COMPLETION OF THE INSPECTION REQUIRED ABOVE AND RESULTANT CORRECTIONS, THE SUBCONTRACTOR WILL COMPLETE ALL PRELIMINARY PREPARATIONS (INSTALLATION OF THERMOCOUPLES ON TANK, FIRING DEVICES, INSULATION, TANK COVERING, ETC.) FOR STRESS RELIEF. ALL THERMOCOUPLES AND LEADS WILL BE CHECKED BY DU PONT PRIOR TO STARTING THE STRESS RELIEF OPERATION. THE PREPARATORY STRESS RELIEF WORK WILL THEN BE JOINTLY INSPECTED BY THE SUBCONTRACTOR AND DU PONT REPRESENTATIVES FOR GENERAL COMPLIANCE WITH DRAWINGS AND SPECIFICATIONS. THIS INSPECTION BY DU PONT SHALL NOT BE CONSTRUED AS RELIEVING THE SUBCONTRACTOR OF HIS RESPONSIBILITY.

3.4.7

DIMENSIONAL TOLERANCES AFTER STRESS RELIEF SHALL MEET THE

REQUIREMENTS OF PARAGRAPH 3.1.4 AND PARAGRAPH 3.1.5.

3.4.8

ANY REQUIRED REPAIR WELDING, CUTTING, BURNING OR OTHER HIGH TEMPERATURE WORK ON THE TANK AFTER COMPLETION OF THE STRESS RELIEVING OPERATION WILL REQUIRE THAT THE STRESS RELIEF OPERATION BE REPEATED. TOTAL TANK STRESS RELIEVING CANNOT BE DONE WITH THE CONCRETE TANK TOP IN PLACE. FOR THIS REASON, THE SUBCONTRACTOR SHALL TAKE ADEQUATE PRECAUTIONS TO INSURE THAT ALL TANKS HAVE BEEN FABRICATED AND TESTED IN ACCORDANCE WITH ALL REQUIREMENTS BEFORE STRESS RELIEF, AND THEN INSTITUTE SUCH CONTROL PROCEDURES AS REQUIRED TO MAINTAIN TANK INTEGRITY.

3.4.9

WELDING ON THE TANK ROOF PLATES AFTER STRESS RELIEF WILL BE PERMITTED PROVIDED ADEQUATE PRECAUTIONS ARE TAKEN TO PROTECT AREAS BELOW THE ROOF PLATES THESE PROTECTIVE MEASURES MUST BE APPROVED BY DU PONT IN WRITING PRIOR TO ANY WELDING OR CUTTING.

3.5. SCALE REMOVAL AFTER STRESS RELIEVING /19/ /31/

3.5.1

IF ROOF PLATES ARE NOT GRIT BLASTED, UPON COMPLETION OF THE STRESS RELIEVING FOR EACH TANK, ALL LOOSE SCALE SHALL BE REMOVED FROM THE INSIDE SURFACE. TIGHTLY ADHERING SCALE WILL BE ALLOWED TO REMAIN. **LOOSE SCALE** IS DEFINED AS SCALE THAT WILL BECOME DETACHED BY HAND OPERATED WIRE BRUSH. THE CLEANING METHOD IS AT THE OPTION OF THE SUBCONTRACTOR, SUBJECT TO DU PONT APPROVAL.

4. INSPECTION & TESTING

4.1. RADIOGRAPHIC EXAMINATION

4.1.1

ALL WELDS SPECIFIED IN PARAGRAPH 4.1.2 BELOW SHALL BE EXAMINED BY RADIOGRAPHIC TECHNIQUES IN ACCORDANCE WITH SECTION VIII, DIVISION 2, OF THE ASME BOILER AND PRESSURE VESSEL CODE, ARTICLE I-5 AND WITH THE REQUIREMENTS AND INTENT OF THIS SPECIFICATION.

4.1.2

THE FOLLOWING WELDS SHALL BE RADIOGRAPHICALLY EXAMINED BY THE SUBCONTRACTOR.

4.1.2.1

ALL BUTT WELDS ON THE PRIMARY STEEL TANKS JOINING PLATES, INCLUDING KNUCKLES, COLUMN PLATES AND CAPITAL PLATES EXCEPT WELDS ON THE HORIZONTAL ROOF SURFACE.

4.1.2.2

ALL BUTT WELDS ON THE SECONDARY STEEL TANKS JOINING PLATES ON THE BOTTOM, KNUCKLE PLATES, COLUMN PLATES, COLUMN CAPITAL PLATES, AND WALL PLATES.

4.1.2.3

ALL WELD EXTENSIONS ON PLATE SURFACES AT INTERSECTIONS OF WELDS DESCRIBED IN PARTS 4.1.2.1 AND 4.1.2.2 ABOVE.

4.1.3 /15/

SAFETY REQUIREMENTS INVOLVING RADIOGRAPHY SHALL CONFORM TO THE NATIONAL BUREAU OF STANDARDS RULES AND THE CODE OF FEDERAL REGULATIONS, TITLE 10, PART 34.

4.1.4

RADIOGRAPH WORK SHALL BE PERFORMED AT HOURS OTHER THAN THE NORMAL DAY SHIFT. EXCEPTIONS TO THIS REQUIREMENT SHALL BE APPROVED BY DU PONT IN WRITING.

4.1.5

FINE GRAIN FILM WITH LEAD SCREENS SHALL BE USED FOR RADIOGRAPH EXAMINATIONS. MINIMUM LEAD SCREEN THICKNESS SHALL BE .005". CALCIUM TUNGSTATE INTENSIFYING SCREENS ARE NOT ACCEPTABLE.

4.1.6

AT LOCATIONS WHERE IT IS NOT PHYSICALLY POSSIBLE TO POSITION AN X-RAY MACHINE, IRIDIUM 192 MAY BE USED AFTER RECEIVING DU PONT APPROVAL. THE USE OF COBALT 60 IS SPECIFICALLY PROHIBITED.

4.1.7

DETAILS OF METHOD OF IDENTIFYING X-RAY EXPOSURE LOCATIONS SHALL BE SUBJECT TO DU PONT APPROVAL.

4.1.8

RECORDS SHALL BE MADE BY THE SUBCONTRACTOR IN THE FORM OF CHARTS WHICH WILL LOCATE THE RADIOGRAPHIC EXPOSURE ON EACH WELD AND WHICH WILL BE REFERENCED TO THE TANK IN THE SAME MANNER AS WELD SEAMS ARE LOCATED. AS SPECIFIED IN PARAGRAPH 1.9.3 OF THIS SPECIFICATION. THE SUBCONTRACTOR SHALL INDICATE ON THE CHART ALL WELD REPAIR LOCATIONS AND NUMBER OF REPAIRS AT EACH LOCATION.

4.1.9

NO PUNCH MARKS WILL BE PERMITTED ON THE INNER SURFACES OF THE PRIMARY STEEL TANKS. STENCILLED NUMBERS MAY BE USED FOR IDENTIFICATION OF X-RAY EXPOSURE LOCATIONS AS LONG AS APPROVED MARKING PAINT IS USED WHICH WILL BE CONSUMED DURING STRESS RELIEF OPERATIONS. AS AN ALTERNATIVE, TAPE, SECURELY CEMENTED, MAY BE USED TO IDENTIFY X-RAY EXPOSURE LOCATIONS.

4.1.10

THE LENGTH OF WELD COVERED BY EACH RADIOGRAPHIC EXPOSURE NORMALLY SHALL NOT EXCEED 15 INCHES. THIS PROVIDES FOR THE USE OF STANDARD 17 INCH LONG FILMS WITH A ONE INCH OVERLAP ON EACH END. LARGER EXPOSURE AREA MAY BE USED PROVIDED THE SUBCONTRACTOR DEMONSTRATES THAT THE REQUIRED SENSITIVITY CAN BE OBTAINED ON ALL PORTIONS OF THE RESULTANT RADIOGRAPH.

4.1.11

THE PRIMARY TANK AND SECONDARY LINER BOTTOM ASSEMBLIES WILL BE RADIOGRAPHICALLY EXAMINED WHILE RESTING ON CRIBBING. THIS INCLUDES ALL WELDS IN THE BOTTOM ASSEMBLIES AS DESIGNATED IN PARAGRAPH 4.1.2. THE SUBCONTRACTOR WILL BE REQUIRED TO MOVE THE CRIBBING AS NECESSARY TO OBTAIN COMPLETE RADIOGRAPHS OF ALL WELDS. DEFECTIVE WELDS WILL THEN BE REPAIRED AND RECHECKED TO DETERMINE THE ACCEPTABILITY OF THE REPAIR. THIS WILL BE REPEATED AS OFTEN AS NECESSARY UNTIL ALL WELDS ARE APPROVED.

4.1.12

IT IS THE RESPONSIBILITY OF THE SUBCONTRACTOR TO PROVIDE THE COMPETENT INTERPRETATION OF RADIOGRAPHS. THE SUBCONTRACTOR SHALL SUBMIT HIS ACCEPTED RADIOGRAPHS TO THE DU PONT INSPECTION ENGINEER ON AN AGREED UPON SCHEDULE FOR REVIEW BY A QUALIFIED DU PONT REPRESENTATIVE. ALL RADIOGRAPHS SUBMITTED TO DU PONT FOR REVIEW WILL BE RETURNED TO THE SUBCONTRACTOR WITHIN TWO WORKING DAYS.

4.1.13

REVIEW BY DU PONT OF ACCEPTABLE RADIOGRAPHS IS TO ASSURE COMPLIANCE WITH ARTICLE I-5 OF SECTION VIII, DIVISION 2, OF THE ASME BOILER AND PRESSURE VESSEL CODE AND WITH THE SUPPLEMENTARY PROVISIONS OF THIS SPECIFICATION.

4.1.14

THE SUBCONTRACTOR'S INTERPRETER SHALL MAKE A TISSUE PAPER TRACING FROM EACH RADIOGRAPH THAT CONTAINS IMPERFECTIONS OF REJECTABLE SIZE. THIS TRACING SHALL SHOW THE POSITION OF THE DEFECT WITH RESPECT TO THE PERMANENT IDENTIFICATION MARKS ON THE OUTSIDE SURFACE OF THE TANK AND TEMPORARY LEAD MARKERS (AS USED) ON THE INNER SURFACE. WHEN A WELD IS FOUND TO CONTAIN A REJECTABLE IMPERFECTION, ALL RADIOGRAPHS OF THAT WELD SHALL BE RETAINED UNTIL THE WELD HAS BEEN REPAIRED AND AN ACCEPTABLE RADIOGRAPH OBTAINED. (SEE PARAGRAPH BELOW FOR DISPOSITION OF RADIOGRAPHS.) A COMPARISON SHALL BE MADE BETWEEN THE RADIOGRAPHS TO INSURE THAT THE SAME AREAS HAVE BEEN RE-RADIOGRAPHED.

4.1.15 REPORTS

4.1.15.1

FIELD REPORTS: THE SUBCONTRACTOR'S RADIOGRAPHIC INTERPRETER SHALL ISSUE A REPORT DAILY INDICATING THE TOTAL NUMBER OF EXPOSURES MADE, WELDS RADIOGRAPHED (BY IDENTIFICATION NUMBER), AND HIS ANALYSIS OF EACH RADIOGRAPH (WHETHER IT IS ACCEPTABLE OR REJECTED). WHEN THE REPORT INCLUDES RADIOGRAPHS OF WELDS WHICH HAVE BEEN REPAIRED, IT SHALL INDICATE THAT THE WELD IS A REPAIR WELD AND SHALL INDICATE HOW MANY TIMES THE WELD HAS BEEN REPAIRED. THE SUBCONTRACTOR SHALL FURNISH DU PONT WITH A CHART OF EACH TANK WHICH WILL INDICATE THE LOCATION OF EACH WELD AND THE LOCATIONS OF THE INDIVIDUAL RADIOGRAPHIC EXPOSURES. THE DU PONT REPRESENTATIVE WILL USE

THIS CHART TO KEEP A CHECK ON THE PROGRESS OF THE RADIOGRAPHIC EXAMINATION BY CHECKING OFF THE INDIVIDUAL EXPOSURE LOCATIONS AS HE RECEIVES REPORTS FROM THE INTERPRETER. ALL RADIOGRAPHS, INCLUDING BOTH REJECTED AND ACCEPTABLE FILMS, SHALL BE RETAINED BY THE SUBCONTRACTOR FOR THE LENGTH OF TIME THAT THEY ARE OF VALUE TO HIM. ALL RADIOGRAPHS SHALL BE TURNED OVER TO DU PONT BY THE SUBCONTRACTOR IN NUMERICAL ORDER AT THE CONCLUSION OF THE JOB.

4.1.15.2 /16/

SHOP REPORTS: PARTS WHICH ARE WELDED AND INSPECTED IN THE CONTRACTOR'S SHOP SHALL CONFORM TO THE SAME PROCEDURES AS DEFINED IN PARAGRAPH 4.1.15.1 EXCEPT THAT AFTER THE WELDS ARE JUDGED ACCEPTABLE BY THE RESIDENT DU PONT INSPECTOR, THE RADIOGRAPHS SHALL BE SUBMITTED TO HIM IMMEDIATELY BY THE SUBCONTRACTOR. THE DU PONT INSPECTOR WILL SIGN EACH INSPECTION REPORT AND SEND THEM, WITH THE RADIOGRAPHS, BY UNITED PARCEL SERVICE TO:

E.I. DU PONT DE NEMOURS CO. INC.
SAVANNAH RIVER PLANT
CENTRAL SHOPS RECEIVING
DUNBARTON, S.C. 29801

ATTENTION: B. YOUNG, TESTING & INSPECTION

4.1.16

ALL RADIOGRAPHS SHALL BE INTERPRETED IN ACCORDANCE WITH SECTION VIII, DIVISION 2, OF THE ASME BOILER AND PRESSURE VESSEL CODE, ARTICLE 1-5, AND THE INTERPRETATION STANDARDS LISTED BELOW.

4.1.17

TO ASSIST IN THE INTERPRETATION OF RADIOGRAPHS IN THOSE SITUATIONS NOT COVERED BY THE ASME CODE, THE FOLLOWING INTERPRETATION STANDARDS ARE GIVEN.

4.1.17.1

THE ASME CODE POROSITY CHARTS ARE ADEQUATE FOR INTERPRETATION OF RADIOGRAPHS IN WHICH THE POROSITY IS SPHERICAL IN SHAPE. WHEN A SPOT OF POROSITY IS ELONGATED, IT SHALL BE REJECTED WHEN THE LONGEST DIMENSION EXCEEDS THE DIAMETER SHOWN ON THE ASME CODE POROSITY CHART

FOR THE APPLICABLE PLATE THICKNESS AND POROSITY DISTRIBUTION.

4.1.17.2

IN INSTANCES WHERE THE IMAGE OF A DEFECT HAS AN APPEARANCE WHICH COULD BE CAUSED BY A CRACK OR LACK OF FUSION AS WELL AS A FINE SLAG STRINGER, AND IT IS NOT POSSIBLE TO DETERMINE ACCURATELY THE NATURE OF THE DEFECT, THE WELD SHALL BE REJECTED.

4.1.18

AT LOCATIONS WHERE THE RADIOGRAPH INTERPRETER OBSERVES CHANGES IN DENSITY ON THE RADIOGRAPH WHICH INDICATES THAT THE THICKNESS OF THE WELD AND OF THE ADJACENT BASE METAL HAS BEEN REDUCED TO A NOTICEABLE DEGREE BY GRINDING, HE SHALL COMPARE THE DENSITY OF THE LOW AREA WITH THAT OF AN APPLICABLE STANDARD RADIOGRAPH SHOWING A STEP BLOCK AND SHALL DETERMINE THE DEPTH OF THE LOW AREA ACCORDINGLY. IF THE DEPTH OF THE LOW AREA EXCEEDS 1/16 INCH, THE AREA SHALL BE BUILT UP WITH WELD METAL TO AT LEAST THE ORIGINAL THICKNESS, GROUND TO REMOVE WELD RIPPLE AND RE-X-RAYED.

4.1.19

SMOOTH LOW AREAS (NOT UNDERCUTS) ADJACENT TO WELDS WILL BE ACCEPTABLE, PROVIDED THAT THEY DO NOT EXCEED 1/32 INCH IN DEPTH AND BLEND SMOOTHLY INTO THE PLATE AND WELD SURFACES.

4.1.20

WHEN THE RADIOGRAPH OF THE ACTUAL WELD SHOWS BUT ONE TYPE OF IMPERFECTION WHICH IS EQUAL TO OR BETTER THAN THE BORDERLINE REFERENCE STANDARD, THE CORRESPONDING PORTION OF THE WELD SHALL BE CONSIDERED AS ACCEPTABLE WITHOUT REPAIR. IF THE DEFECTS ARE MORE NUMEROUS THAN INDICATED BY THE BORDERLINE STANDARD, THE WELD SHALL BE UNACCEPTABLE UNTIL PROPERLY REPAIRED.

4.1.21

WHEN ONE TYPE OF DEFECT PREDOMINATES AND THE OTHER TYPES ARE BETTER THAN THE BORDERLINE STANDARD FOR THEIR PARTICULAR CLASS, THE BORDERLINE STANDARD OF THE PREDOMINATING DEFECT SHALL GOVERN WITHOUT REGARD TO THE OTHER TYPES OF DEFECTS.

4.1.22

WHEN TWO OR MORE TYPES OF DEFECTS ARE PRESENT TO AN EXTENT EQUAL TO THE BORDERLINE STANDARD FOR EACH TYPE, ALL BORDERLINE DEFECTS

SHALL BE CONSIDERED UNACCEPTABLE AND THE WELD SHALL BE REJECTED UNTIL PROPERLY REPAIRED.

4.1.23

IN GENERAL, THERE WILL BE NO LIMIT WITH REGARD TO THE EXTENT OF ACCEPTABLE DEFECTS THROUGHOUT THE AREA ON A PARTICULAR WELD, PROVIDED THAT NO AREA CONTAINS DEFECTS IN EXCESS OF THOSE INDICATED ON THE BORDERLINE STANDARD.

4.1.24 /17/

THE SUBCONTRACTOR WILL BE EXPECTED TO REPAIR ALL WELD DEFECTS DETECTED BY HIS RADIOGRAPH INTERPRETER WITHOUT CONSULTING THE DU PONT INSPECTION ENGINEER. DU PONT WILL ISSUE FINAL APPROVAL ON ALL RADIOGRAPH INTERPRETATION OF WELDS.

4.2. VACUUM LEAK TESTING

4.2.1 /18/

THE FOLLOWING WELDS ARE TO BE VACUUM LEAK TESTED BY THE SUBCONTRACTOR IN ACCORDANCE WITH THE INTENT AND PROCEDURE SPECIFIED BELOW:

1. ALL BUTT WELDS IN THE SECONDARY TANKS EXCEPT THE ROOF PLATES.

2. LEAK DETECTION SUMP AT SECONDARY CENTER COLUMN.

3. ALL BUTT WELDS IN THE PRIMARY TANKS, EXCEPT THE ROOF PLATES, PRIOR TO STRESS RELIEF.

4. REPEAT VACUUM TEST FOR ALL BUTT WELDS IN THE PRIMARY TANK AFTER STRESS RELIEF IF THEY CANNOT BE OBSERVED DURING THE HYDROSTATIC TEST.

VACUUM LEAK TESTING OF THE TANK BOTTOMS MUST BE DONE AFTER THEY HAVE BEEN LOWERED INTO POSITION.

4.2.2

ALL VACUUM LEAK TESTS SHALL BE PERFORMED IN THE PRESENCE OF THE DU PONT INSPECTION ENGINEER AT THE SITE.

4.2.3

THE VACUUM BOX USED FOR VACUUM TESTING FOR LEAKS IS TO BE SUFFICIENT STRENGTH TO WITHSTAND A VACUUM OF 6 PSI. THE TOP OF

THE BOX IS TO HAVE A WINDOW IN IT OF SUFFICIENT SIZE AND TRANSPARENCY AS TO PERMIT CLOSE OBSERVATION OF THE WELD BEING TESTED. THE BOX SHALL BE OF SUCH SIZE, SHAPE AND DESIGN TO PERMIT TESTING OF ALL WELDS REQUIRING THE VACUUM LEAK TEST.

4.2.4

METHOD OF VACUUM LEAK TESTING. (1) CLEAN TEST AREA OF ALL RUST (2) COVER THE WELD THOROUGHLY WITH A SOAP SOLUTION. (3) PLACE THE VACUUM BOX OVER THE WELD AND INDUCE A VACUUM OF 6 PSI. THIS VACUUM IS TO BE HELD AS LONG AS NECESSARY IN THE OPINION OF THE DU PONT INSPECTION ENGINEER TO PROVIDE SATISFACTORY OBSERVATIONS.

4.2.5

ANY LEAKS REVEALED BY THE VACUUM LEAK TEST ARE TO BE REPAIRED IN ACCORDANCE WITH THIS SPECIFICATION.

4.3. HYDROSTATIC TESTS

4.3.1

A FULL HYDROSTATIC TEST WILL CONSIST OF FILLING THE PRIMARY TANK WITH WATER TO A DEPTH OF THIRTY-TWO (32) FEET MINIMUM AND ALLOWING TO STAND FOR FORTY-EIGHT (48) HOURS.

4.3.2

AT THE OPTION OF THE SUBCONTRACTOR, A FULL HYDROSTATIC TEST OF THE PRIMARY STEEL TANKS CAN BE MADE UPON COMPLETION OF TANK ERECTION, THE RADIOGRAPHIC EXAMINATION OF WELDS, AND REPAIR WELDS. THIS HYDROSTATIC TEST SHALL PRECEDE THE STRESS RELIEF OPERATION.

4.3.3 /22/

A FULL HYDROSTATIC TEST OF THE PRIMARY STEEL TANKS WILL BE REQUIRED AFTER THE TANKS HAVE BEEN STRESS RELIEVED.

4.3.4

ANY LEAKS DETECTED DURING THE REQUIRED HYDROSTATIC TEST ARE TO BE REPAIRED IN ACCORDANCE WITH THIS SPECIFICATION, AND THE TANK MUST THEN BE RESTRESS RELIEVED IN ACCORDANCE WITH PARAGRAPH 3.4.8.

4.3.5

ALL WELDED JOINT SURFACES ON THE OUTSIDE OF THE PRIMARY TANKS (EXCLUDING BOTTOM) ARE TO BE SUFFICIENTLY CLEANED TO PERMIT ADEQUATE INSPECTION OF THE WELD SEAM AREA DURING THE HYDROSTATIC

TESTS.

4.3.6

VISUAL INSPECTION SHALL BE CONDUCTED JOINTLY BY THE SUBCONTRACTOR AND THE DU PONT INSPECTION ENGINEER TO DETERMINE IF THERE ARE ANY LEAKS.

4.3.7

THE HOLD TIME FOR THE HYDROSTATIC TEST IS TO BE ADJUSTED TO COMPENSATE FOR RAINY WEATHER CONDITIONS. THE INSPECTION OF THE PRIMARY TANK FOR LEAKS SHALL TAKE PLACE AT A TIME WHICH INSURES AGAINST CONDITIONS THAT WILL CAUSE THE TANK TO SWEAT.

4.3.8

HYDROSTATIC TESTING IS PROHIBITED WHEN WEATHER CONDITIONS INDICATE THE POSSIBILITY OF FREEZING CONDITIONS DURING THE TEST PERIOD.

4.3.9

ALL WATER USED IN THE HYDROSTATIC TESTING OF TANKS IS TO BE DISPOSED OF IN STORM DRAINAGE SYSTEM AS DIRECTED BY THE DU PONT INSPECTION ENGINEER.

4.4. MAGNETIC PARTICLE AND DYE PENETRANT TESTS

4.4.1

ALL AREAS AS SPECIFIED IN PARAGRAPH 4.4.2 BELOW SHALL BE CHECKED FOR DEFECTS BY MAGNETIC PARTICLE EXAMINATION TECHNIQUES IN ACCORDANCE WITH SECTION VIII OF THE ASME BOILER AND PRESSURE VESSEL CODE, APPENDIX VI OR BY THE LIQUID PENETRANT EXAMINATION TECHNIQUE IN ACCORDANCE WITH SECTION VIII OF THE ASME BOILER AND PRESSURE VESSEL CODE, APPENDIX VIII AND WITH THE REQUIREMENTS AND INTENT OF THIS SPECIFICATION.

4.4.2

THE FOLLOWING AREAS SHALL BE CHECKED BY THE SUBCONTRACTOR.

4.4.2.1

ALL AREAS ON THE INSIDE AND OUTSIDE SURFACES OF THE PRIMARY TANKS WHERE CLIPS, LUGS, ETC., HAVE BEEN REMOVED AND/OR REPAIRED AND ALL AREAS WHERE PLATE DAMAGE HAS BEEN REPAIRED BY FILLING, WELDING, GRINDING, ETC., EXCEPT THE SURFACES OF THE HORIZONTAL ROOF PLATES.

4.4.2.2

ALL AREAS ON THE INSIDE SURFACE OF THE SECONDARY TANKS WHERE CLIPS, LUGS, ETC. HAVE BEEN REMOVED AND DAMAGE REPAIRED AND ALL AREAS WHERE PLATE DAMAGE HAS BEEN REPAIRED.

4.4.2.3

THE FIRST AND LAST WELD PASS ON ALL WELDS CONNECTING INLET PIPING AND COOLING COIL RISER PIPES TO THE PRIMARY TANKS.

4.4.3

ALL MAGNETIC PARTICLE AND DYE PENETRANT EXAMINATIONS SHALL BE MADE IN THE PRESENCE OF THE DU PONT INSPECTION ENGINEER.

4.4.4

THE SURFACES TO BE EXAMINED SHALL BE CLEAN, DRY, FREE FROM OIL, LOOSE RUST, OR LOOSE SCALE.

4.4.5

THE EXAMINATION OF DESIGNATED AREAS SHALL BE REPEATED AS MANY TIMES AS NECESSARY, IN THE OPINION OF THE DU PONT INSPECTION ENGINEER, TO PROVIDE ACCURATE AND SATISFACTORY INTERPRETATION OF DEFECTS.

4.4.6

ANY DEFECTS REVEALED BY MAGNETIC PARTICLE OR DYE PENETRANT EXAMINATIONS ARE TO BE REPAIRED IN ACCORDANCE WITH THIS SPECIFICATION AND RE-EXAMINED.

4.5. PROCEDURE FOR WELD TESTING OF COIL SUPPORT PLATES

4.5.1 /24/

PRIOR TO STRESS RELIEVING, MAKE PRESSURE CONNECTION TO STRESS RELIEF VENT HOLE IN COIL SUPPORT PLATE. ATTACH TO SOURCE OF 6 PSI MINIMUM NITROGEN OR AIR PRESSURE.

4.5.2

APPLY SOAP SOLUTION TO THE ENTIRE WELD AREA AND THE HEAT AFFECTED ZONE.

4.5.3

IF ANY BUBBLES APPEAR ON APPLICATION OF PRESSURE, THE WELD SHALL BE REJECTED AND REPAIRED.

4.5.4

WELD TESTS FOR COIL SUPPORT PLATES SHALL BE PERFORMED IN THE PRESENCE OF THE DU PONT INSPECTION ENGINEER.

4.6. PLATE INSPECTION

4.6.1

PLATE THICKNESS SHALL BE CHECKED FOR COMPLIANCE WITH ASTM A20 REQUIREMENTS AT THE VENDOR'S SHOP PRIOR TO SHOP FABRICATION OR EDGE PREPARATION. PLATES SHALL BE REJECTED OR REPAIRED IF THEY DO NOT MEET ASTM A20 REQUIREMENTS.

4.6.2

ALL PLATES SHALL BE INSPECTED FOR COLD LAPS, SURFACE IMPERFECTIONS, STRINGER SEPARATIONS AT EDGES, ETC.

/21/

4.6.3

PRIMARY TANK PLATES SHALL BE CLEANED AND INSPECTED ON BOTH SIDES AS FOLLOWS: THE STEEL MANUFACTURER, OR SUBCONTRACTOR, SHALL REMOVE SCALE AND OXIDE BY BLAST CLEANING TO THE EXTENT NECESSARY TO DISCLOSE SURFACE IMPERFECTIONS AS DEFINED IN ASTM A20. IF REMOVAL OF SUCH IMPERFECTIONS REDUCES THE PLATE THICKNESS BELOW THE UNDER TOLERANCE (SEE PARAGRAPH 3.1.7) THE PLATE SHALL BE REJECTED OR REPAIRED AT THE STEEL MANUFACTURER'S OPTION. IF REPAIR IS MADE, THE PROCEDURE OF A20 SHALL BE FOLLOWED.

4.6.4

VENDOR SHALL SUBMIT SHOP INSPECTION PROCEDURES FOR PLATES USED IN THIS WORK AS PART OF QUALITY ASSURANCE PROCEDURE.

SPECIFICATION NO. 7100
CHRONOLOGICAL SUMMARY OF REVISIONS

Rev. No.	Superseded Data
/2/	1.4.1 Codes referred to in this specification are to be the latest revision to date and are part of this specification as if fully presented herein.
/3/	1.4.2 ASME Boiler and Pressure Vessel Code Section VIII and Section IX shall apply with the following exceptions: calculations and code stamp are not required. Quality control system description per Section VIII, Appendix X must be furnished with bid for Du Pont approval. Code Case 1586-2 shall not apply.
/4/	1.8.3.2 Wood supports are preferred to minimize risk of damage to tank plates during placing and removal. If metal supports are used, a temporary wood flooring will be required to protect the tank bottom. The subcontractor shall submit his design for the temporary roof supports to Du Pont for approval prior to fabrication.
/5/	1.8.3.3 Normal construction schedule requires supports remain in place for approximately 8 weeks.
/6/	1.9.1 The subcontractor shall submit to Du Pont one month prior to use, complete drawing details; and welding procedure qualification tests in accordance with Section IX of the ASME Boiler and Pressure Vessel Code covering all shell closure welds, structural welds and fillet welds.

Rev. No.

Superseded Data

/7/ 1.9.4

Subcontractor's drawings will be checked for general conformity to dimensions and material specifications only. Drawings will be returned marked "Approved", "Approved as Noted", or "Not Approved - Resubmit for Approval" within 15 working days after receipt. Drawings marked "Approved" or "Approved as Noted" release the vendor for fabrication. One sepia or 16 prints of "Approved" and corrected "Approved as Noted" drawings must be returned to Du Pont two (2) weeks prior to field erection for Du Pont distribution.

/8/ 2.1.1

Steel plate for construction of the secondary tanks shall be ASTM A516, Grade 70 as rolled. Steel plate for construction of the primary tanks shall be ASTM A537, Class I. Mill test reports are required for all steel plates per Section 1.7 of this specification. For normalized steel, ASTM A537, Class I, Supplementary Requirement S6, drop weight test is to be made for each mill plate 5/8" thick and over (test to be made at -10°F and failure is cause for rejection); plates under 5/8" thick shall be tested in accordance with supplementary requirement S5 Charpy V-Notch, applied transverse to plate rolling direction (test to be made at -10°F and impact results under 15'-lbs. shall be cause for rejection).

/9/ 3.1.5

The tank bottoms shall be flattened after lowering and prior to trimming so that the maximum height of any distortion shall not exceed 3". This height shall be measured from the top of the concrete foundation for the secondary bottom and from top of the insulating layer for the primary bottom. The maximum slope on any distortion shall not exceed 0.33" per foot. The flatness tolerance applies to any area on the tank bottom (within the knuckle radius limits) in the post heat treat condition. The proper flatness tolerance is to be achieved by any appropriate means excluding the use of sledge hammers or equivalent. Any flattening operations shall be applied prior to the stress relieving operation. No flattening will be allowed after stress relieving.

Rev. No.	Superseded Data
/10/	3.1.6 Only those openings in the tanks which appear on the approved shop drawings will be permitted. No holes or temporary access openings shall be cut in the steel tank plates below the tank roof plates. Plate sections above the knuckle plates may be temporarily left out to serve as access doors provided they are welded in place prior to stress relieving. All welding on the primary tank for side inlet nozzles and/or sleeves below the primary roof plates shall be complete before stress relief. Roof risers and roof attachments should be installed before stress relief if possible.
/11/	4. All cored samples shall be air dried for 24 hours and then oven dried at 230 degrees F for 24 hours prior to testing.
/12/	5. The minimum cold crushing strength of any core shall not be less than 380 psi.
/13/	3.4.1.2 The primary tank shall be held at or above 1,100°F for not less than one hour. During the holding period the difference between the highest and the lowest temperatures on the tank shall not exceed 150°F. In addition, any thermocouple 15' apart or less shall not show a temperature differential greater than 125°F.
/14/	3.4.5 Upon receipt of a stress relief notification, the subcontractor and authorized representatives designated by Du Pont will make a joint inspection of the tank. Defects, discrepancies, omissions, etc., revealed in this inspection shall be corrected as requested by Du Pont representatives. Equipment shall be provided by the subcontractor, such as scaffolding on wheels, to inspect all areas of the tank within 2-1/2 feet of the plate surfaces.

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/15/ 4.1.3

Safety requirements involving radiography shall conform to the National Bureau of Standards rules and/or the United States Energy Research and Development Administration Rules and Regulations, Title 10, Part 34, whichever is applicable.

/16/ 4.1.15.2

Shop Reports: Parts which are welded and inspected in the subcontractor's shop shall conform to the same procedures as defined in Paragraph 4.1.15.1 except that after the welds are judged acceptable by the resident Du Pont Inspection Engineer, the radiographs shall be submitted to him immediately by the subcontractor. The Du Pont Inspection Engineer will sign each inspection report and send them, with the radiographs, by United Parcel Post to:

E. I. du Pont de Nemours & Co., Inc.
Savannah River Plant
Central Shops Receiving
Dunbarton, S.C. 29801

Attention: B. Young, Testing & Inspection

/17/ 4.1.24

The subcontractor will be expected to repair all weld defects detected by his radiograph interpreter without consulting the Du Pont Inspection Engineer.

/18/ 4.2.1

The following welds are to be vacuum leak tested by the subcontractor in accordance with the intent and procedure specified below:

4.2.1.1 Before Stress Relief:

1. All butt welds joining plates on the bottom assembly, including knuckles and lower part of column of the secondary tanks after they have been lowered into final position.

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/18/ 4.2.1.1 (Continued)

2. All butt welds joining plates on the wall, column, and capital sections of the secondary and primary tanks.

3. All butt welds joining plates on the bottom assembly, including knuckle and lower part of column, on the primary tanks after they have been lowered into final position.

4.2.1.2 After Stress Relief:

1. All butt welds joining plates on the walls, bottom, column, and capital section of the primary tanks after stress relief, and before hydrostatic test, if they cannot be visually inspected during the hydrostatic test.

3.5. SCALE REMOVAL AFTER HEAT TREATMENT

/19/ 3.5.1

Upon completion of the stress relief operation on each of the tanks, all loose scale shall be removed from the inside of the primary tanks. Tightly adhering scale will be allowed to remain. "Loose Scale" is defined as scale that will become detached by hand operated wire brush. The cleaning method is at the option of the subcontractor, subject to Du Pont approval.

/20/ 3.1.7

Sharp gouges, deep scratches, or any other surface blemish caused during erection or during mill production, in excess of 1/32" in depth, will not be permitted on the inner surface of the primary and secondary tank walls or bottom. The imperfections shall be ground out and if the resulting depression exceeds 1/16", it shall be filled with weld metal. The subcontractor shall provide protection of completed portions of the primary and secondary steel tanks to avoid damage insofar as possible. On the primary tanks, surface of plates containing mill stencil markings shall be placed on the exterior side

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/20/ 3.1.7 (Continued)

of the tank. At the subcontractor's option, the primary tank bottom plates may be placed with mill stencil marks up to eliminate the need to turn over plates that are shipped with stencil marks up, provided they are ground smooth and repaired as specified above.

/21/ 4.6.3

Primary tank plates shall be cleaned and inspected on both sides as follows: The steel manufacturer shall remove scale and oxide by blast cleaning to the extent necessary to disclose surface imperfections as defined in ASTM A20. If removal of such imperfections reduces the plate thickness below the under tolerance specified in A20, the plate shall be rejected or repaired at the steel manufacturer's option. If repair is made, the procedure of A20 shall be followed.

/22/ 4.3.3

A full hydrostatic test of the primary steel tanks will be required after the tanks have been stress relieved and after scale removal.

/23/ 3.4.1.1

Above 600°F the rate of heating shall not be more than 100°F per hour. During the heating period the difference between the highest and the lowest temperatures on the tank shall not exceed 200°F. In addition, any thermocouple 15' apart or less shall not show a temperature differential greater than 125°F.

/24/ 4.5.1

Make convenient pressure connection to stress-relief vent hole in coil support plate. Attach to source of 6 psi minimum nitrogen or air pressure.

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Superseded Data

/25/ 1.8.12

The subcontractor will be responsible for performing all operations in connection with raising and lowering the tank bottom and knuckle for all primary steel tanks and secondary steel tanks. He shall submit to Du Pont for approval included in "Construction Schedule" per Paragraph 1.8.4, his proposed method for raising, shoring, protection of the insulating layer, lowering and final alignment of both primary and secondary bottom and knuckle assemblies.

/26/ 1.8.3.1

The temporary roof supports shall be of adequate strength and configuration to permit the horizontal roof plates to be used as the supporting form for placing the concrete roof. (The minimum design load for the temporary roof supports shall be for a dead load plus live load of 800 pounds per square foot).

/27/ 1.8.3.3

Vendor's schedule should assume 12 weeks for work by Du Pont Construction forces, while temporary roof supports are in place.

/28/ 3.1.6

Only those openings in the tanks which appear on the approved shop drawings will be permitted. No holes or temporary access openings shall be cut in the steel tank plates below the tank roof plates. Plate sections above the knuckle plates may be temporarily left out to serve as access doors provided they are welded in place prior to stress relieving. All welding on the primary tank below the primary roof plates, except for side nozzles, shall be complete before stress relief. Preferably, roof risers, roof attachments, and side nozzles will be installed before stress relief.

/29/ 3.3.3.2 Testing by Du Pont

5. The minimum cold crushing strength of any core shall not be less than 380 psi for samples cured at 230 degrees F and 300 psi for samples cured at 1100 degrees F.

Rev. No.	Superseded Data
/30/	2.1.1 Steel plate for construction of the secondary tanks shall be ASTM A516, Grade 70 as rolled. Steel plate for construction of the primary tanks shall be ASTM A537, Class I, Commercial quality grit blasted at the steel mill or at the subcontractor's shop. Mill test reports are required for all steel plates per Section 1.7 of this specification. For normalized steel, ASTM A537, Class I, Supplementary Requirement S6, drop weight test is to be made for each mill plate 5/8" thick and over (test to be made at -10°F and failure is cause for rejection); plates under 5/8" thick shall be tested in accordance with supplementary requirement S5 Charpy V-Notch, applied transverse to plate rolling direction (test to be made at -10°F and impact results under 15'-lbs. shall be cause for rejection).
/31/	3.5 (Was deleted. See Rev. /19/)
/32/	3.1.7-2A (New paragraph added.)