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John C. Stennis Space Center
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SSTD-8070-0063-PIPE
Rev. C
MARCH 2021

COMPLIANCE IS MANDATORY

John C. Stennis Space Center PIPE SYSTEM 3-1/2% NICKEL FOR HIGH PRESSURE SERVICE “Y”

Approved by:

<u>C. Brennan Sanders</u> NASA SSC Center Operations Facilities Engineering Test Complex Support	<u>3-24-2021</u> Date
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Concurrence by:

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<u>Son Le</u> NASA SSC Safety & Mission Assurance	<u>3-23-2021</u> Date
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Issued by

<u>ISSUED CEF</u> Central Engineering Files	<u>3-24-2021</u> Date
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Stennis Standard	SSTD-8070-0063-PIPE	C
	<i>Number</i>	<i>Rev.</i>
	Effective Date: March 25, 2021	
	Review Date: March 25, 2026	
Page 2 of 10		
Responsible Office: NASA SSC Center Operations Facilities Engineering Test Complex Support		
SUBJECT: Pipe System 3-1/2% Nickel for High Pressure Service “Y”		

Document History Log

Change/ Revision	Change Date	Originator / Phone	Description
Basic	12/11/2015	Doug Dike, Ext. 2803	Initial release, supersedes SSC-47-037.
Basic-1	02.16.2016	R. Carol Wolfram Ext. 1164	Administrative change. Replaced “Test Operations Contract” with “Test Contract” throughout document.
A	03/25/2016	Benny McGrath Ext. 2969	6.0 Requirements: Added “Seamless” to ½” through 1½” pipe; and added “ASTM A333 Gr. 3 (3-1/2% nickel) to 2” through 4” pipe.
B	09/04/2019	Larry DeQuay Ext. 8-1956	Updated directorate titles on cover as necessary. Updated acronyms. Section 2.0: Added statements for clarification of applicability. Section 5.0: Added air, gaseous nitrogen, RP-1, and gaseous methane. Section 6.0: Within Pressure Test section of Requirements, changed “ASME PCC-2, Part 5, Section 6.2” changed to “ASME PCC-2, Part 5, Article 501, Sub-article 501-6.2.” Also, “subsection 6.2 (<i>k</i>)” changed to “Sections (<i>i</i>) and (<i>l</i>) of this sub-article.”
C	03/25/2021	Larry DeQuay Ext. 8-1956	Five-year review. Updated directorate titles on cover sheet as necessary. Updated references and acronyms. Minor administrative changes. Removed “Gas” from the document title, following the inclusion of the service fluids that are liquids. Section 5.0: Added Isopropyl Alcohol and Jet Propellants 4, 5, 7 and 8.

Stennis Standard	SSTD-8070-0063-PIPE	C
	<i>Number</i>	<i>Rev.</i>
	Effective Date: March 25, 2021	
	Review Date: March 25, 2026	
Page 3 of 10		
Responsible Office: NASA SSC Center Operations Facilities Engineering Test Complex Support		
SUBJECT: Pipe System 3-1/2% Nickel for High Pressure Service “Y”		

Table of Contents

1.0	PURPOSE	4
2.0	APPLICABILITY.....	4
3.0	REFERENCES.....	4
4.0	RESPONSIBILITIES.....	5
5.0	DESIGN REQUIREMENTS	5
6.0	REQUIREMENTS.....	6
7.0	RECORDS AND FORMS.....	9
8.0	ACRONYMS AND ABBREVIATIONS.....	9

Stennis Standard	SSTD-8070-0063-PIPE	C
	<i>Number</i>	<i>Rev.</i>
	Effective Date: March 25, 2021	
	Review Date: March 25, 2026	
Page 4 of 10		
Responsible Office: NASA SSC Center Operations Facilities Engineering Test Complex Support		
SUBJECT: Pipe System 3-1/2% Nickel for High Pressure Service “Y”		

1.0 PURPOSE

This John C. Stennis Space Center (SSC) standard (SSTD) specifies materials and procedures to be used for the construction of the high pressure service “Y” piping system at SSC.

2.0 APPLICABILITY

- 2.1 This SSTD shall be used for specifying materials and components to be incorporated into piping system “Y” as designated on the Site-wide Operational and Repair Documentation (SORD) Drawing system. These piping system drawings are drawn in schematic form, and are identified by system and specifications code number in accordance with SSTD-8070-0112-IDCODES.
- 2.2 This SSTD applies to repairs or alterations of existing pipes with “Y” designation.
- 2.3 This SSTD may be used for new construction. However, the design engineer should use SSTD-8070-0044-PIPE, unless the design requirements necessitate the use of this SSTD.

3.0 REFERENCES

All references are assumed to be the latest version unless otherwise indicated.

ANSI B16.9, *Factory-Made Wrought Buttwelding Fittings*

ASME B31.3, *Process Piping*

ASME Boiler and Pressure Vessel Code, Section IX, *Welding, Brazing, and Fusing Qualifications*

ASME SA182/ASTM A182, *Standard Specification for Forged or Rolled Alloy and Stainless Steel Pipe Flanges, Forged Fittings, and Valves and Parts for High-Temperature Service*

ASME SA193, *Standard Specification for Alloy-Steel and Stainless Steel Bolting Materials for High Temperature or High Pressure Service and Other Special Purpose Applications*

ASME SA194, *Standard Specification for Carbon Steel, Alloy Steel, and Stainless Steel Nuts for Bolts for High Pressure or High Temperature Service, or Both*

ASME SA266, *Standard Specification for Carbon Steel Forgings for Pressure Vessel Components*

ASTM A333, *Standard Specification for Seamless and Welded Steel Pipe for Low-Temperature Service and other Applications with Required Notch Toughness*

ASME SA350, *Standard Specification for Carbon and Low-Alloy Steel Forgings, Requiring Notch Toughness Testing for Piping Components*

ASTM A370, *Standard Test Methods and Definitions for Mechanical Testing of Steel Products*

ASTM A420, *Standard Specification for Piping Fittings or Wrought Carbon Steel and Alloy Steel for Low-Temperature Service*

Stennis Standard	SSTD-8070-0063-PIPE	C
	<i>Number</i>	<i>Rev.</i>
	Effective Date: March 25, 2021	
	Review Date: March 25, 2026	
Page 5 of 10		
Responsible Office: NASA SSC Center Operations Facilities Engineering Test Complex Support		
SUBJECT: Pipe System 3-1/2% Nickel for High Pressure Service “Y”		

NACE 4140 MR 0175/ISO 15156, *Petroleum and natural gas industries - Materials for use in H₂S-containing environments in oil and gas production (Parts 1 and 2)*

RPTSTD-8070-0001, *Surface Cleanliness Standard of Fluid Systems for Rocket Engine Test Facilities of the NASA Rocket Propulsion Test Program*

SPR 1440.1, *SSC Records Management Program Requirements*

SSTD-8070-0005-CONFIG, *SSC Preparation, Review, Approval, and Release of SSC Standards*

SSTD-8070-0013-WELD, *Classes of Welding Inspection*

SSTD-8070-0112-IDCODES, *Test Complex Line Designator Numbers*

SSTD-8070-0130-WELD, *Gas Tungsten Arc Welding of 3-1/2% Nickel Steel (P-No. 9B, Group 1) to Carbon Steel (P-No. 1, Group 1 or 2)*

SSTD-8070-0136-WELD, *Gas Tungsten Arc Welding of ASTM A333 Grade 3 Material*

4.0 RESPONSIBILITIES

- a. Users of this SSTD shall comply with its requirements, ensure use of the correct version of this SSTD and the documents it references, and inform the appropriate organization of needed changes in accordance with SSTD-8070-0005-CONFIG.
- b. Responsibilities for the use and control of this SSTD and for the review and approval of revisions or cancellation of this SSTD shall be as specified in SSTD-8070-0005-CONFIG and the applicable documents referenced therein.

5.0 DESIGN REQUIREMENTS

<u>Service</u>	<u>Design Pressure</u>	<u>Temperature Range</u>
(High Pressure) Air (HA)	3,700 psig	-50°F to +150°F
Helium (HE)	6,300 psig	-50°F to +150°F
Isopropyl Alcohol (IPA)	6,300 psig	-50°F to +150°F
Gaseous Hydrogen (GH)	6,300 psig	-50°F to +150°F
Gaseous Methane (GM)	6,300 psig	-50°F to +150°F
Gaseous Nitrogen (GN)	6,300 psig	-50°F to +150°F
Jet Propellant 4 (JP-4)	6,300 psig	-50°F to +150°F
Jet Propellant 5 (JP-5)	6,300 psig	-50°F to +150°F
Jet Propellant 7 (JP-7)	6,300 psig	-50°F to +150°F
Jet Propellant 8 (JP-8)	6,300 psig	-50°F to +150°F
Rocket Propellant 1 (RP-1)	6,300 psig	-50°F to +150°F

Stennis Standard	SSTD-8070-0063-PIPE	C
	<i>Number</i>	<i>Rev.</i>
	Effective Date: March 25, 2021	
	Review Date: March 25, 2026	
Page 6 of 10		
Responsible Office: NASA SSC Center Operations Facilities Engineering Test Complex Support		
SUBJECT: Pipe System 3-1/2% Nickel for High Pressure Service “Y”		

6.0 REQUIREMENTS

Size	½” thru 1 ½ ”	2” thru 4”
Pipe	ASTM A333 Gr. 3 (3½% nickel) Seamless Sch. 160	ASTM A333 Gr. 3 (3-1/2% nickel) Seamless XXS
Fittings	ASTM A420 GrWPL3 ANSI B16.9 (Buttweld) Sch. 160	ASTM A420 GrWPL3 ANSI B16.9 (Buttweld) XXS

Continued on next page.

Stennis Standard	SSTD-8070-0063-PIPE	C
	<i>Number</i>	<i>Rev.</i>
	Effective Date: March 25, 2021	
	Review Date: March 25, 2026	
Page 7 of 10		
Responsible Office: NASA SSC Center Operations Facilities Engineering Test Complex Support		
SUBJECT: Pipe System 3-1/2% Nickel for High Pressure Service "Y"		

Size	1/2" thru 4"																																				
Grayloc Buttweld Hubs See Note 1.	<p>ASME SA350 Grade LF2 Class 2, ASME SA350 Grade LF3 Class 2, or ASME SA182 Grade F11.</p> <p>If the buttweld hub material is ASME SA182 Grade F11, material samples traceable to hubs made from the same heat number shall be Charpy V-notch impact tested in accordance with ASTM A370 to qualify the material to -50°F service temperatures, and a weld procedure specification (WPS) needs to be developed and qualified per ASME Boiler and Pressure Vessel Code, Section IX to weld P-No. 4 Group 1 to P-No. 9B Group 1 base metals. This WPS needs to be used for welding buttweld hubs to pipe and other fittings.</p> <table border="0"> <tr> <td style="text-align: center;">Nom. Pipe Size</td> <td style="text-align: center;">Hub Size</td> <td style="text-align: center;">Cat. No.</td> <td style="text-align: center;">Nom. Pipe Size</td> <td style="text-align: center;">Hub Size</td> <td style="text-align: center;">Cat. No.</td> </tr> <tr> <td style="text-align: center;">1/2"</td> <td style="text-align: center;">1GR4 (1/2")</td> <td style="text-align: center;">Contact</td> <td style="text-align: center;">2"</td> <td style="text-align: center;">2GR14</td> <td style="text-align: center;">Contact</td> </tr> <tr> <td style="text-align: center;">3/4"</td> <td style="text-align: center;">1GR4 (3/4")</td> <td style="text-align: center;">Gray</td> <td style="text-align: center;">2-1/2"</td> <td style="text-align: center;">2-1/2GR20</td> <td style="text-align: center;">Gray</td> </tr> <tr> <td style="text-align: center;">1"</td> <td style="text-align: center;">1GR7</td> <td style="text-align: center;">Tool</td> <td style="text-align: center;">3"</td> <td style="text-align: center;">3GR25</td> <td style="text-align: center;">Tool</td> </tr> <tr> <td style="text-align: center;">1-1/2"</td> <td style="text-align: center;">1-1/2GR14</td> <td style="text-align: center;">Co.</td> <td style="text-align: center;">4"</td> <td style="text-align: center;">4GR31</td> <td style="text-align: center;">Co.</td> </tr> </table>	Nom. Pipe Size	Hub Size	Cat. No.	Nom. Pipe Size	Hub Size	Cat. No.	1/2"	1GR4 (1/2")	Contact	2"	2GR14	Contact	3/4"	1GR4 (3/4")	Gray	2-1/2"	2-1/2GR20	Gray	1"	1GR7	Tool	3"	3GR25	Tool	1-1/2"	1-1/2GR14	Co.	4"	4GR31	Co.						
Nom. Pipe Size	Hub Size	Cat. No.	Nom. Pipe Size	Hub Size	Cat. No.																																
1/2"	1GR4 (1/2")	Contact	2"	2GR14	Contact																																
3/4"	1GR4 (3/4")	Gray	2-1/2"	2-1/2GR20	Gray																																
1"	1GR7	Tool	3"	3GR25	Tool																																
1-1/2"	1-1/2GR14	Co.	4"	4GR31	Co.																																
Grayloc Seal Rings	<p>Polytetrafluoroethylene (PTFE) Coated 17-4PH (UNS No. S17400) Stainless Steel or PTFE Coated NACE 4140 (UNS No. G41400) Carbon Steel.</p> <p>The PTFE coating shall not be applied to the seal ring inside diameter and shall conform to Figure 1 below.</p> <p>If the seal material is PTFE Coated NACE 4140, material samples traceable to seal rings made from the same heat number shall be Charpy-V-notch impact tested in accordance with ASTM A370 to qualify the material to -50°F service temperatures.</p> <p>Also, all NACE 4140 material used for seal rings shall be certified to MR0175/ISO 15156 Parts 1 and 2.</p> <table border="0"> <tr> <td style="text-align: center;">Nom. Seal Pipe Size</td> <td style="text-align: center;">Ring Size</td> <td style="text-align: center;">17-4PH S/S Cat. No.*</td> <td style="text-align: center;">NACE 4140 Steel Cat. No.*</td> </tr> <tr> <td style="text-align: center;">1/2"</td> <td style="text-align: center;">4</td> <td style="text-align: center;">51230N</td> <td style="text-align: center;">50554N</td> </tr> <tr> <td style="text-align: center;">3/4"</td> <td style="text-align: center;">4</td> <td style="text-align: center;">51230N</td> <td style="text-align: center;">50554N</td> </tr> <tr> <td style="text-align: center;">1"</td> <td style="text-align: center;">7</td> <td style="text-align: center;">51232N</td> <td style="text-align: center;">66020N</td> </tr> <tr> <td style="text-align: center;">1-1/2"</td> <td style="text-align: center;">14</td> <td style="text-align: center;">51235N</td> <td style="text-align: center;">50553N</td> </tr> <tr> <td style="text-align: center;">2"</td> <td style="text-align: center;">14</td> <td style="text-align: center;">51235N</td> <td style="text-align: center;">50553N</td> </tr> <tr> <td style="text-align: center;">2-1/2"</td> <td style="text-align: center;">20</td> <td style="text-align: center;">51236N</td> <td style="text-align: center;">50557N</td> </tr> <tr> <td style="text-align: center;">3"</td> <td style="text-align: center;">25</td> <td style="text-align: center;">51237N</td> <td style="text-align: center;">50570N</td> </tr> <tr> <td style="text-align: center;">4"</td> <td style="text-align: center;">31</td> <td style="text-align: center;">51239N</td> <td style="text-align: center;">50561N</td> </tr> </table> <p>*Above Cat. Nos. are for Grayloc seal rings. Specify "EWS" coating qualifier for all seal ring catalog numbers and purchases. Equals to Grayloc parts permitted with pre-qualification.</p> <div style="text-align: center;"> <p>Figure 1</p> </div>	Nom. Seal Pipe Size	Ring Size	17-4PH S/S Cat. No.*	NACE 4140 Steel Cat. No.*	1/2"	4	51230N	50554N	3/4"	4	51230N	50554N	1"	7	51232N	66020N	1-1/2"	14	51235N	50553N	2"	14	51235N	50553N	2-1/2"	20	51236N	50557N	3"	25	51237N	50570N	4"	31	51239N	50561N
Nom. Seal Pipe Size	Ring Size	17-4PH S/S Cat. No.*	NACE 4140 Steel Cat. No.*																																		
1/2"	4	51230N	50554N																																		
3/4"	4	51230N	50554N																																		
1"	7	51232N	66020N																																		
1-1/2"	14	51235N	50553N																																		
2"	14	51235N	50553N																																		
2-1/2"	20	51236N	50557N																																		
3"	25	51237N	50570N																																		
4"	31	51239N	50561N																																		

Continued on next page.

Stennis Standard	SSTD-8070-0063-PIPE	C
	<i>Number</i>	<i>Rev.</i>
	Effective Date: March 25, 2021	
	Review Date: March 25, 2026	
Page 8 of 10		
Responsible Office: NASA SSC Center Operations Facilities Engineering Test Complex Support		
SUBJECT: Pipe System 3-1/2% Nickel for High Pressure Service "Y"		

Size	½" thru 4"																																				
Code Compliance	ASME B31.3																																				
Grayloc Clamp Sets See Note 2.	<p>SA193 Grade B7/B7M. (Prior to the issue date of this standard, cast or forged clamp material having same nominal composition as that of ASTM A182 Gr. F6a or F6b for 1" and smaller sizes and SA266 Gr. 1 clamp material for 1-1/2" thru 4" sizes is permitted.) Stud Material: SA193 Gr. B7; Nut Material: SA194 Gr. 2 or 2H.</p> <table border="1"> <thead> <tr> <th>Size</th> <th>Hub Size</th> <th>Cat. No. (Clamp) *</th> <th>Cat. No. (Bolting) *</th> </tr> </thead> <tbody> <tr> <td>½"</td> <td>1GR4 (1/2")</td> <td>A90019-5WB</td> <td>70944</td> </tr> <tr> <td>¾"</td> <td>1GR4 (3/4")</td> <td>A90019-5WB</td> <td>70944</td> </tr> <tr> <td>1"</td> <td>1GR7</td> <td>A90019-5WB</td> <td>70944</td> </tr> <tr> <td>1-½"</td> <td>1-1/2GR14</td> <td>A90043-1WB</td> <td>69001</td> </tr> <tr> <td>2"</td> <td>2GR14</td> <td>A90148-5WB</td> <td>69002</td> </tr> <tr> <td>2-½"</td> <td>2-1/2GR20</td> <td>A19413-6WB (2-½")</td> <td>69003</td> </tr> <tr> <td>3"</td> <td>3GR25</td> <td>A19413-6WB (3")</td> <td>69003</td> </tr> <tr> <td>4"</td> <td>4GR31</td> <td>A90372-4WB</td> <td>69006</td> </tr> </tbody> </table> <p>* Above Catalog Nos. are for Grayloc parts; qualified equals are permitted</p>	Size	Hub Size	Cat. No. (Clamp) *	Cat. No. (Bolting) *	½"	1GR4 (1/2")	A90019-5WB	70944	¾"	1GR4 (3/4")	A90019-5WB	70944	1"	1GR7	A90019-5WB	70944	1-½"	1-1/2GR14	A90043-1WB	69001	2"	2GR14	A90148-5WB	69002	2-½"	2-1/2GR20	A19413-6WB (2-½")	69003	3"	3GR25	A19413-6WB (3")	69003	4"	4GR31	A90372-4WB	69006
Size	Hub Size	Cat. No. (Clamp) *	Cat. No. (Bolting) *																																		
½"	1GR4 (1/2")	A90019-5WB	70944																																		
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1"	1GR7	A90019-5WB	70944																																		
1-½"	1-1/2GR14	A90043-1WB	69001																																		
2"	2GR14	A90148-5WB	69002																																		
2-½"	2-1/2GR20	A19413-6WB (2-½")	69003																																		
3"	3GR25	A19413-6WB (3")	69003																																		
4"	4GR31	A90372-4WB	69006																																		
Welding / Inspection	<p>Weld per SSTD-8070-0130-WELD when welding butt-weld hubs made of SA350 Grade LF2 material to pipe and other fittings. If welding butt-weld hubs made of ASME SA182 Grade F11, a weld procedure specification (WPS) needs to be developed and qualified per ASME Boiler and Pressure Vessel Code, Section IX to weld P-No. 4 Group 1 to P-No. 9B Group 1 base metals. This WPS needs to be used for welding hubs to pipe and other fittings. Weld per SSTD-8070-0136-WELD for all other cases. Weld inspections shall be in accordance with SSTD-8070-0013-WELD Class I requirements.</p>																																				
Pressure Tests	<p>All pressure testing shall be in accordance with ASME B31.3 requirements for "leak testing" (unless otherwise noted in the design). All tests shall be held for the period required for inspection of all joints with no loss in gage pressure or 10 minutes, whichever is greater.</p> <p>For pneumatic testing: Pneumostatic pressure tests are permitted only for cases where:</p> <ol style="list-style-type: none"> 1. All safety precautions stated in ASME PCC-2, Part 5, Article 501, Sub-article 501-6.2 have been reviewed with supporting documentation and implemented to the maximum extent practicable and where they do not conflict with allowances and requirements of this standard; 2. All safety precautions mandated by ASME PCC-2, Part 5, Article 501, Sub-article 501-6.2, with the exception of Sections (i) and (l) or this sub-article, have been implemented and documented; and 3. The NASA/SSC safety organization has approved this type of test. 																																				

Continued on next page.

Stennis Standard	SSTD-8070-0063-PIPE	C
	<i>Number</i>	<i>Rev.</i>
	Effective Date: March 25, 2021	
	Review Date: March 25, 2026	
Page 9 of 10		
Responsible Office: NASA SSC Center Operations Facilities Engineering Test Complex Support		
SUBJECT: Pipe System 3-1/2% Nickel for High Pressure Service "Y"		

Size	1/2" thru 4"
Cleaning	Precision clean in accordance with RPTSTD-8070-0001 to the cleanliness level specified for service media and system or to level indicated on piping system drawings.

NOTES:

1. Use only non-tapped hubs unless absolutely necessary. If tapped hubs are needed, contact Gray Tool Co. for further information.
2. Carbon steel clamp and bolting material is specified for use with low alloy steel hubs in this pipe service with operating range of -50°F to +150°F.

7.0 RECORDS AND FORMS

Records and forms required by the procedures of this standard shall be maintained in accordance with SPR 1440.1. All records and forms are assumed to be the latest edition unless otherwise indicated. Forms may be obtained from the SSC Electronic Forms repository or from the NASA SSC Forms Management Officer. Quality Records are identified in the SSC Master Records Index.

8.0 ACRONYMS AND ABBREVIATIONS

ANSI	American National Standards Institute
ASME	American Society of Mechanical Engineers
ASTM	American Society of Testing and Materials
°	degrees
F	Fahrenheit
GH	Gaseous Hydrogen
GM	Gaseous Methane
GN	Gaseous Nitrogen
HA	High Purity Air
HE	Helium
IPA	Isopropyl Alcohol
ISO	International Organization for Standardization
NACE	National Association of Corrosion Engineers
NASA	National Aeronautics and Space Administration
psig	pounds per square inch gage
PTFE	polytetrafluoroethylene
RP	Rocket Propellant
RPTSTD	Rocket Propulsion Testing Standard
SORD	Site-Wide Operational and Repair Documentation
SPR	Stennis Procedural Requirement

Stennis Standard	SSTD-8070-0063-PIPE	C
	<i>Number</i>	<i>Rev.</i>
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	Review Date: March 25, 2026	
Page 10 of 10		
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SSC	John C. Stennis Space Center
SSTD	John C. Stennis Space Center Standard
SPR	Stennis Procedural Requirements
UNS	Unified Numbering System
WPS	Weld Procedure Specification