ANGRA 1 RPV and Pressurizer Ageing Management Programs

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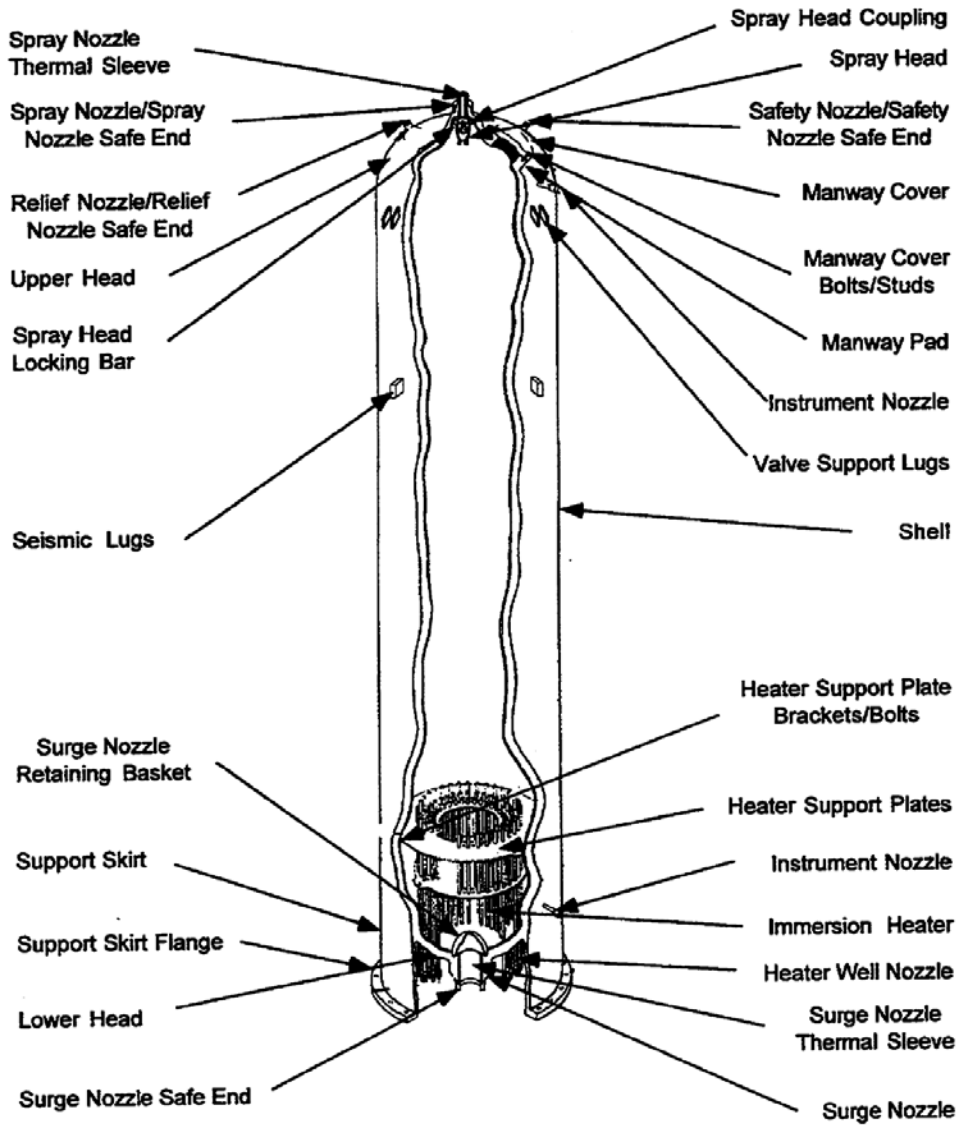
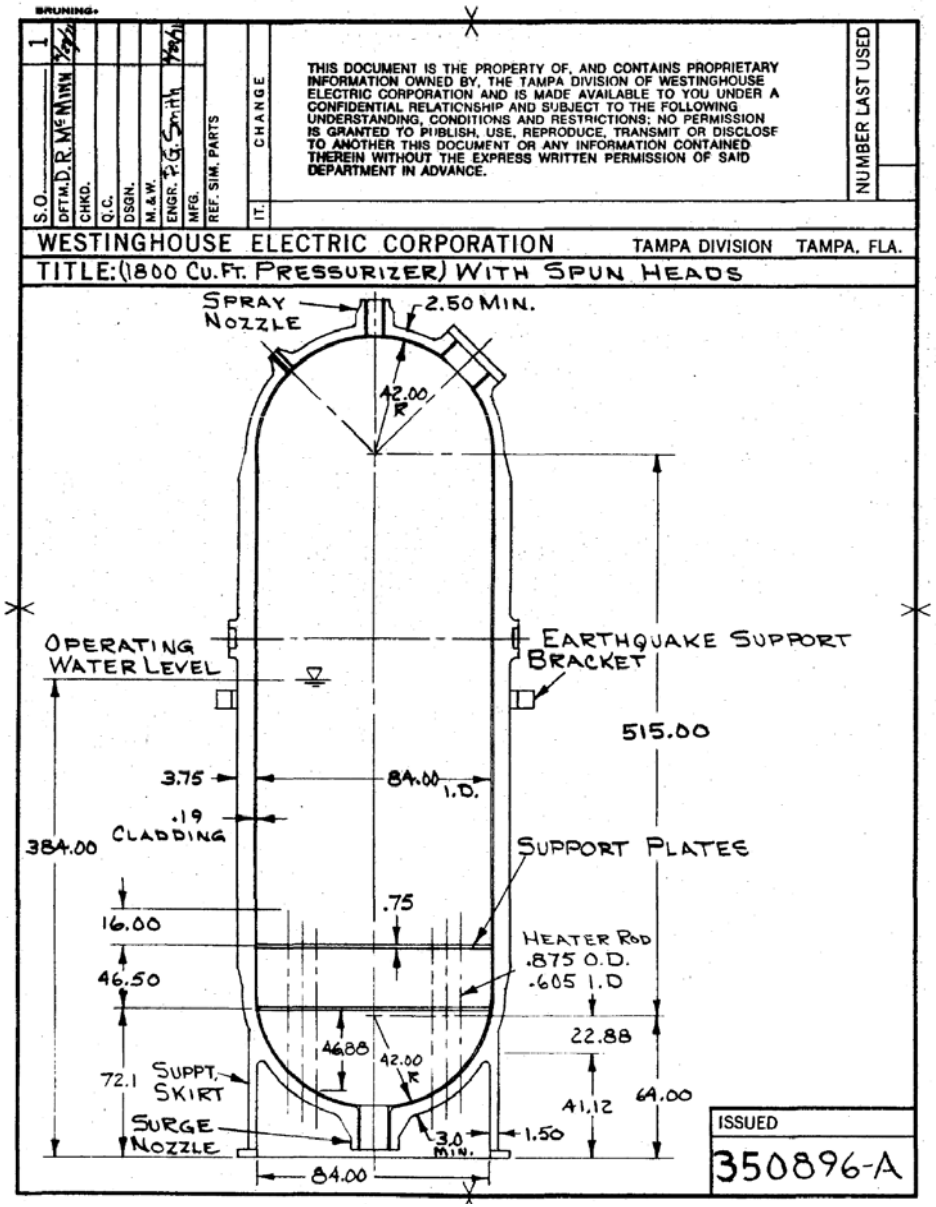
Sections for ANGRA 1 RPV and Pressurizer Ageing Management Programs

- Component description
- Subcomponents requiring ageing management review
- Internal operational experience review
- External operational experience review
- Applicable internal programs related to ageing management program
- **Ageing assessment matrix**

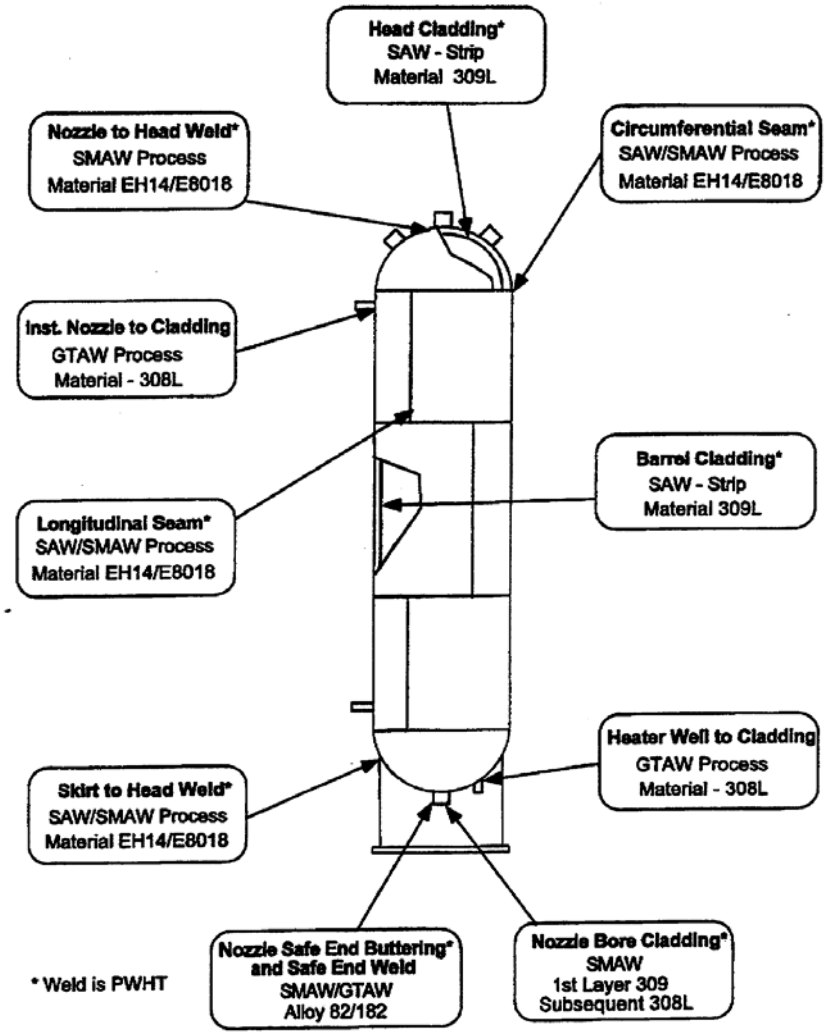
ANGRA 1 Pressurizer Series 84



ANGRA 1 Pressurizer Series 84



ANGRA 1 Pressurizer Series 84



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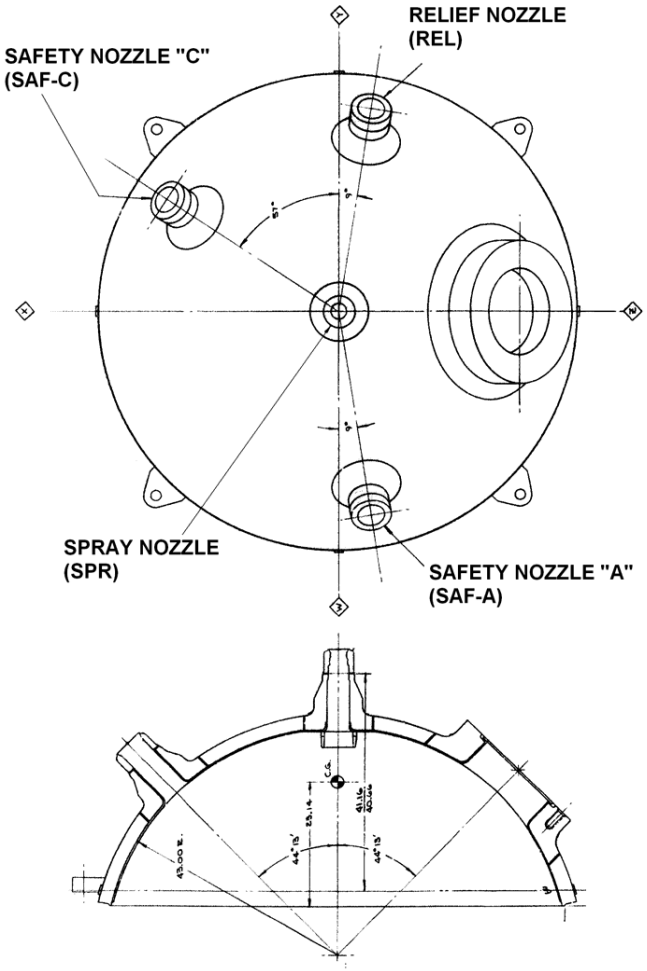

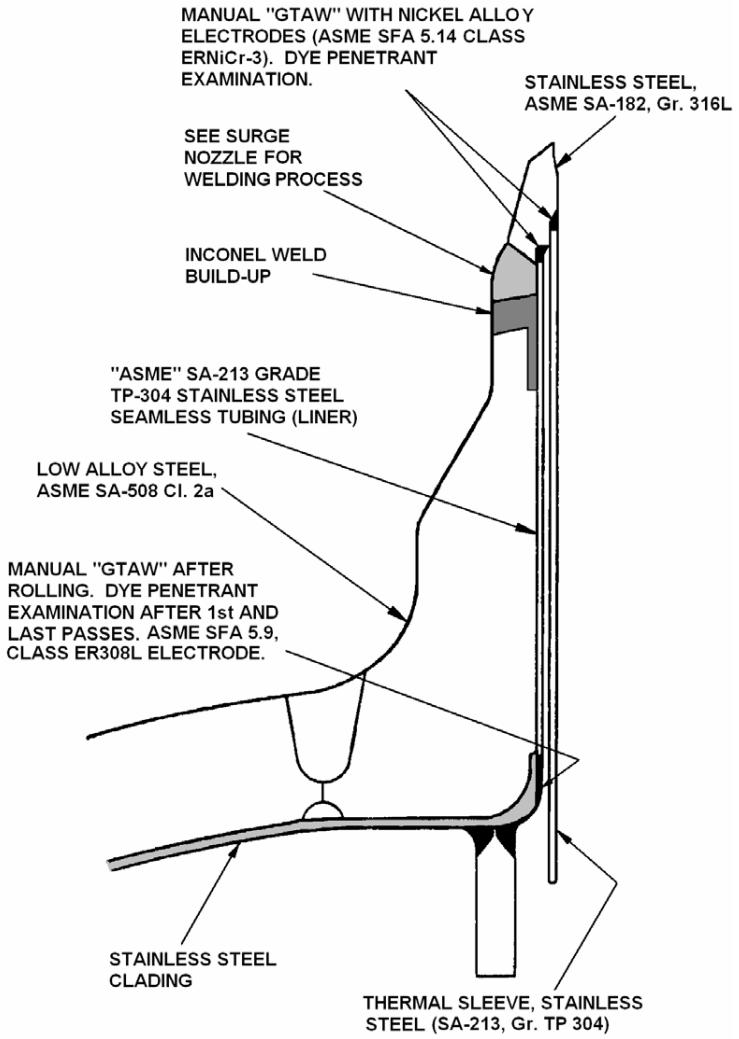

External Operational Experience

- Fatigue in the lower head and surge nozzles from reactor coolant insurge and outsurge transients.
- Primary stress corrosion cracking of Alloy 600 materials in the primary system.
- Cracking of pressurizer vessel cladding
- Instrument nozzle cracking.
- Damage to immersion heater ceramic seals and elements.
- Leaking at the manway gasket seal.

Time Limited Ageing Analysis

Subcomponent	Design Fatigue Usage[1]	Projected Fatigue Service (Years)[2]
Upper Head	0.100	400
Shell	0.906[3]	44
Spray Nozzle	0.821	49
Safety and Relief Nozzle	0.161	248
Manway Bolts	0.875	46
Manway Pad	0.141	284
Manway Cover	0.100	400
Valve Support Bracket	0.102	392
Seismic Support Lugs [6]	0.970[3]	41
Lower Head [4]	0.200	200
Heater Well [4]	0.130	308
Immersion Heater	0.122	328
Surge Nozzle [4]	0.955	42
Instrument Nozzle	0.166	241
Support Skirt and Flange [5, 6]	0.736	54

ANGRA 1 Pressurizer Ageing Assessment Matrix

Ageing Assessment					
System - Branch	Pressurizer				
Component	**Function**	**Material**	**Internal Environment I** **External Environment E**	**Aging Effects Requiring Management**	**Aging Management Activity**
Heater Well and Heater Sheath	Pressure Boundary	Stainless Steel	E (Air)	None	None required
			I (Treated Water)	Cracking	Chemistry Control Program for Primary Systems
					ISI Program - Component and Component Support Inspections
				Loss of Material	Chemistry Control Program for Primary Systems
Instrument Nozzles	Pressure Boundary	Stainless Steel	E (Air)	None	None required
			I (Treated Water)	Cracking	Augmented Inspection Activities
					Chemistry Control Program for Primary Systems
				Loss of Material	ISI Program - Component and Component Support Inspections
Lower Head (and cladding)	Pressure Boundary	Carbon Steel and Low-Alloy Steel	E (Air)	None	None required
		Stainless Steel	I (Treated Water)	Cracking	Chemistry Control Program for Primary Systems
				Loss of Material	Chemistry Control Program for Primary Systems

ANGRA 1 Pressurizer Ageing Assessment Matrix

Ageing Assessment					
System - Branch	Pressurizer				
Component	**Function**	**Material**	**Internal Environment I / External Environment E**	**Aging Effects Requiring Management**	**Aging Management Activity**
Manway (includes Pad and cladding)	Pressure Boundary	Carbon Steel and Low-Alloy Steel	E (Air)	Cracking	ISI Program - Component and Component Support Inspections
		Stainless Steel	I (Treated Water)	Cracking	Chemistry Control Program for Primary Systems
				Loss of Material	Chemistry Control Program for Primary Systems
Manway Cover Bolts	Pressure Boundary	Carbon Steel and Low-Alloy Steel	E (Air)	Tightning loss	ISI Program - Component and Component Support Inspections
Manway Cover With Insert	Pressure Boundary	Carbon Steel and Low-Alloy Steel	E (Air)	None	None required
		Stainless Steel	I (Treated Water/Steam))	Cracking	Chemistry Control Program for Primary Systems
				Loss of Material	Chemistry Control Program for Primary Systems

ANGRA 1 Pressurizer Ageing Assessment Matrix

Ageing Assessment					
System - Branch	Pressurizer				
Component	**Function**	**Material**	**Internal Environment I** **External Environment E**	**Aging Effects Requiring Management**	**Aging Management Activity**
Relief Nozzle (and cladding)	Pressure Boundary	Carbon Steel and Low-Alloy Steel	E (Air)	Nenhum	None required
		Stainless Steel	I (Treated Water/Steam))	Cracking	Chemistry Control Program for Primary Systems
				Loss of Material	Chemistry Control Program for Primary Systems
Relief Nozzle Safe End	Pressure Boundary	Sensitized stainless steel	E (Air)	Nenhum	None required
			I (Treated Water/Steam))	Cracking	Chemistry Control Program for Primary Systems
					ISI Program - Component and Component Support Inspections
				Loss of Material	Chemistry Control Program for Primary Systems
Safety Nozzle (and cladding)	Pressure Boundary	Carbon Steel and Low-Alloy Steel	E (Air)	Nenhum	None required
		Stainless Steel	I (Treated Water/Steam))	Cracking	Chemistry Control Program for Primary Systems
				Loss of Material	Chemistry Control Program for Primary Systems

ANGRA 1 Pressurizer Ageing Assessment Matrix

Ageing Assessment					
System - Branch	Pressurizer				
Component	**Function**	**Material**	**Internal Environment I** **External Environment E**	**Aging Effects Requiring Management**	**Aging Management Activity**
Safety Nozzle Safe End	Pressure Boundary	Sensitized stainless steel	E (Air)	None	None required
			I (Treated Water/Steam))	Cracking	Chemistry Control Program for Primary Systems
					ISI Program - Component and Component Support Inspections
				Loss of Material	Chemistry Control Program for Primary Systems
Sample Line Nozzle	Pressure Boundary	Stainless Steel	E (Air)	Nenhum	None required
			I (Treated Water/Steam))	Cracking	Augmented Inspection Activities1
					Chemistry Control Program for Primary Systems
					ISI Program - Component and Component Support Inspections
				Loss of Material	Chemistry Control Program for Primary Systems
Seismic Support Lugs	Seismic Support	Carbon Steel and Low-Alloy Steel	E (Air)	Cracking	ISI Program - Component and Component Support Inspections

ANGRA 1 Pressurizer Ageing Assessment Matrix

Ageing Assessment					
System - Branch	Pressurizer				
Component	**Function**	**Material**	**Internal Environment I** **External Environment E**	**Aging Effects Requiring Management**	**Aging Management Activity**
Shell (and cladding)	Pressure Boundary	Carbon Steel and Low-Alloy Steel	E (Air)	Cracking	ISI Program - Component and Component Support Inspections
		Stainless Steel	I (Treated Water)	Cracking	Chemistry Control Program for Primary Systems
				Loss of Material	Chemistry Control Program for Primary Systems
Spray Nozzle (and cladding)	Pressure Boundary	Carbon Steel and Low-Alloy Steel	E (Air)	None	None required
		Stainless Steel	I (Treated Water/Steam))	Cracking	Chemistry Control Program for Primary Systems
				Loss of Material	Chemistry Control Program for Primary Systems
Spray Nozzle Safe End	Pressure Boundary	Sensittized stainless steel	E (Air)	None	None required
			I (Treated Water/Steam))	Cracking	Chemistry Control Program for Primary Systems
					ISI Program - Component and Component Support Inspections
				Loss of Material	Chemistry Control Program for Primary Systems

ANGRA 1 Pressurizer Ageing Assessment Matrix

Ageing Assessment					
System - Branch	Pressurizer				
Component	**Function**	**Material**	**Internal Environment I** / **External Environment E**	**Aging Effects Requiring Management**	**Aging Management Activity**
Spray Nozzle Thermal Sleeve	Pressure Boundary	Stainless Steel	I (Treated Water/Steam))	Cracking	Chemistry Control Program for Primary Systems
				Loss of Material	Chemistry Control Program for Primary Systems
Support Skirt and Flange	Seismic support	Carbon Steel and Low-Alloy Steel	E (Air)	Cracking	ISI Program - Component and Component Support Inspections
Surge Nozzle (and cladding)	Pressure Boundary	Carbon Steel and Low-Alloy Steel	E (Air)	None	None required
		Stainless Steel	I (Treated Water/Steam))	Cracking	Chemistry Control Program for Primary Systems
				Loss of Material	Chemistry Control Program for Primary Systems
Surge Nozzle Safe End	Pressure Boundary	Sensitized stainless steel	E (Air)	None	None required
			I (Treated Water/Steam))	Cracking	Chemistry Control Program for Primary Systems
					ISI Program - Component and Component Support Inspections
				Loss of Material	Chemistry Control Program for Primary Systems

ANGRA 1 Pressurizer Ageing Assessment Matrix

Ageing Assessment					
System - Branch	Pressurizer				
Component	**Function**	**Material**	**Internal Environment I** **External Environment E**	**Aging Effects Requiring Management**	**Aging Management Activity**
Surge Nozzle Thermal Sleeve	Pressure Boundary	Stainless Steel	I (Treated Water/Steam))	Cracking	Chemistry Control Program for Primary Systems
				Loss of Material	Chemistry Control Program for Primary Systems
Upper Head (and cladding)	Pressure Boundary	Carbon Steel and Low-Alloy Steel	E (Air)	None	None required
		Stainless Steel	I (Treated Water/Steam))	Cracking	Chemistry Control Program for Primary Systems
				Loss of Material	Chemistry Control Program for Primary Systems

ANGRA 1 Ageing Specific Programs

- Reactor Vessel Radiation Surveillance Program (RPV) (since 1977)
- Reactor Vessel Radiation Surveillance Program (RPV) (1st capsules removal - 1987)
- Reactor Vessel Radiation Surveillance Program (RPV) (2nd capsules removal - 2008)
- Structural Integrity Evaluation of Reactor Vessel Upper Head Penetrations (RPV) (since 2002)
- Reactor Vessel Head Examination (RPV) (2008)
- Reactor Vessel Head Penetrations Examination (RPV) (2008)
- Dissimilar Welding Examination (RPV & PZR) (since 2001)
- Alloy 600/82/182 issues (RPV & PZR) (since 2001)