

### ***Nuclear Industry***

Materials used by the Nuclear Industry are required to maintain the integrity of the structure (i.e. they must be corrosion and radiation resistant and sufficiently robust to withstand their service environment). Stainless steels are widely used in the nuclear industry because they are resistance to corrosion and can be readily fabricated by a variety of techniques. Materials for each application are selected on the basis of their resistance to corrosion in a specific service environment.

In view of the remarks made above, it is difficult to provide a list of stainless steel grades used for specific applications. Although similar considerations to those used for the chemical/process industries apply to nuclear applications, the presence of high radiation fluxes may require additional measures. For example, boron is added to the austenitic stainless steel grade 1.4031 (AISI 304) as a neutron moderator. In addition, the cobalt content of stainless steels used for nuclear applications is often subject to strict limits (e.g. less than 0.3% cobalt for British Nuclear Fuels).

Surface finish tends to have a significant impact on the performance of nuclear plant and equipment. For this reason, specifications for nuclear plant and equipment have a variety of surface finish requirements. Design, workmanship, installation and commissioning have a significant affect on the performance of both the plant and its materials of construction.

Typical applications for stainless steels in nuclear plant and equipment are shown in the table below.

Nuclear Plant and Equipment – Applications, Grades and Human Exposure

Application/Use	Stainless Steel		Human Exposure – Dermal Contact
	Type	EN 10088 Grade	
Processing and reaction vessels, storage tanks and vessels, pumps, pipelines and tubes, heat exchangers, taps and valves. Fume extraction systems (eg fume hoods and ducting) and scrubber units.	Austenitic	1.4305 (AISI 303)*	Transient for producers. Very limited exposure for installers and user due to nature of the processes.
		1.4301 (AISI 304)	
		1.4307 (AISI 304L)	
		1.4541 (AISI 321)	
		1.4401 (AISI 316)	
		1.4401 (AISI 316L)	
		1.4571 (AISI 316Ti)	
		1.4438 (AISI 317L)	
		1.4539 (904L)	
		1.4547 (ASTM S31254)[254 SMO]	
	Duplex	1.4362 (ASTM S32304)[2304]	
		1.4462 (ASTM S31803)[2205]	
		1.4410 (ASTM S32750)[2507]	
	Martensitic	1.4006 (AISI 410)	
		1.4021 (AISI 420)	
		1.4028 (AISI 420)	
		1.4057 (AISI 431)	
Ferritic	1.4016 (AISI 430)		
	1.4521		
	1.4592		

Containment flasks for nuclear waste	Austenitic	1.4301 (AISI 304) with boron and low cobalt content	Transient for producers. Very limited exposure for installers and user due to nature of the processes.
Flooring, walkways, hand rails and structural building components (eg ladders, joists, columns, beams, wall cladding, etc)	Austenitic	1.4301 (AISI 304) 1.4307 (AISI 304L) 1.4401 (AISI 316) 1.4404 (AISI 316L)	Transient for producers. Very limited exposure for installers and user due to nature of the processes.
Fasteners	Austenitic	1.4305 (AISI 303)* 1.4301 (AISI 304) 1.4307 (AISI 304L) 1.4541 (AISI 321) 1.4401 (AISI 316) 1.4404 (AISI 316L) 1.4571 (AISI 316Ti) 1.4438 (AISI 317L) 1.4539 (904L) 1.4547 (ASTM S31254)[254 SMO]	Transient for producers. Very limited exposure for installers and user due to nature of the processes.
	Martensitic	1.4006 (AISI 410) 1.4021 (AISI 420) 1.4028 (AISI 420)	
	Ferritic	1.4057 (AISI 431) 1.4016 (AISI 430)	

\* Resulturised grade 303