Annex T
(informative)

NDE Requirements Summary

Process	Welds Requiring Inspection	Reference Section
Air Test	Reinforcement plate welds inside and outside to 100 kPa (15 lbf/in.^{2}).	7.3.5
Air Test	Welded shell joints if no water is available, if not vacuum tested or tested to 7.3.6, Item 2) a) i) or 7.3.6, Item 2) a) iii).	7.3.6, Item 2) a) ii)
Air Test	Welded shell joints above the hydrostatic test water level, if not vacuum tested or tested to 7.3.7.1, Item 1) or 7.3.7.1, Item 3).	7.3.7.1, Item 2)
Air Test	Roofs designed to be gas-tight if roof seams are not vacuum-box tested.	7.3.8.1 a)
Air Test	Compartment welds of external floating roofs, if not tested with vacuum box or penetrating oil.	C.3.6
Air Test	Annex F roofs during hydro-test of tanks.	F.4.4 F.8.3
Air Test	Aluminum dome roofs, if required to be gas-tight.	G.10.1.2
Air Test	Shop fabricated compartments (pontoons). Test in shop and field.	H.6.4
Air Test	Shop built tanks, if not tested per 7.3.2 through 7.3.8.	J.4.2.2
Hydro	Tank shell.	7.3.7
MT	Flush-type shell connections: Nozzle-to-tank shell, Repad welds, shell-to-bottom reinforcing pad welds on the root pass, each 13 mm ($^1/_2$ in.) of weld, and completed weld. Inspect after stress relieving before hydro-test.	5.7.8.11
MT	Non-structural small attachments, such as insulation clips (not supports) studs and pins, unless tested by liquid penetrant.	7.2.1.12d
MT	Permanent attachment welds and temporary weld removal areas on Group IV, IVA, V, and VI materials, unless tested by liquid penetrant.	7.2.3.6
MT	Completed welds of stress relieved assemblies, after stress relief, but before hydro-test, unless tested by PT.	7.2.3.7
MT	First pass of the internal shell-to-bottom weld unless examined by penetrating oil or PT or VB. Not required if the final weld is tested by pressure (see 7.2.4.2), or if agreed to by Purchaser and the final weld is tested by MT, PT, or VB.	7.2.4.1a
MT	Final shell-to-bottom weld, as alternative to requirements of 7.2.4.1 or 7.2.4.2 either side of the finished joint, if not PT or VB tested.	7.2.4.3c
MT	Shell-to-bottom fillet welds including the root pass, 20 mm ($^1/_2$ in.), and final surface of Annex M tanks for which the stress concentration factor of K = 2.0 is used.	M.4.2
Pen. Oil	First pass of the internal shell-to-bottom weld if approved instead of MT, VB, or PT.	7.2.4.1d
Pen. Oil	Welded shell joints if no water for hydrostatic test and if not tested to the requirements of 7.3.6, Item 2) a) ii) or 7.3.6, Item 2) a) iii).	7.3.6, Item 2) a) i)
Pen. Oil	Welded shell joints above the hydrostatic test water level if not tested to 7.3.7.1, Item 2) or 7.3.7.1, Item 3).	7.3.7.1, Item 1)

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Process	Welds Requiring Inspection	Reference Section
Pen. Oil	Compartment welds of external floating roofs not tested with internal pressure or VB.	C.3.6
Pen. Oil	Deck seams of external floating roofs.	C.4.2
Pen. Oil	Deck seams and other joints that are required to be or vapor-tight unless tested with another method agreed to by the Purchaser and the roof Manufacturer.	H.6.2
PT	Permanent attachment welds and temporary weld removal areas on Group IV, IVA, V, VI materials instead of MT if approved.	7.2.3.6
PT	Completed welds of stress-relieved assemblies, after stress relief, but before hydrostatic test unless tested by MT.	7.2.3.7
PT	First pass of the internal shell-to-bottom weld if approved instead of MT.	7.2.4.1b or c
PT	Final shell-to-bottom weld, as alternative to requirements of 7.2.4.1 or 7.2.4.2 either side of the finished joint if not MT or VB tested.	7.2.4.3c
PT	All aluminum structural welds and components joined by welding.	G.11.3
PT	Stainless steel tank shell-to-bottom welds, opening connections not radiographed all welds of attachments to shells, and all butt welds of annular plates on which backing strips are to remain.	S.4.14.2
PT	Non-structural small attachments such as insulation clips (not supports) studs and pins not welded by capacitor discharge. Unless tested by magnetic particle.	7.2.1.12d
RT	Shell plate butt welds unless examined by UT with Purchaser approval. RT is not required for Annex A, J, and S tanks where the Joint Efficiency of 0.7 is used.	7.3.2.1, A.5.3, S.4.14.1
RT	Butt welds of annular plates that are required by 5.5.1 or M.4.1, unless examined by UT with Purchaser approval.	8.1.2.9
RT	Flush-type shell connections: 100 % of all longitudinal butt welds in the nozzle neck and transition piece, if any, and the first circumferential butt weld in the neck closest to the shell, excluding the neck-to-flange weld, unless examined by UT with Purchaser approval.	5.7.8.11
RT	Shell vertical and horizontal welds which have intersecting openings and repads—100 % over weld length 3 times the diameter of the opening.	5.7.3.4
RT	100 % of the butt-weld around the periphery of an insert plate that extends less than the adjacent shell course height and that contains shell openings and their reinforcing elements.	8.1.2.2d
Tracer Gas	Entire length of bottom weld joints if not tested to 7.3.3a or 7.3.3c.	7.3.3.b
UT	Butt-welds in shell plate, annular-plate, and flush-type connections requiring radiographic examination, with Purchaser approval.	7.3.2.1 8.3.1
VB	First pass of the internal shell-to-bottom weld if approved instead of MT, PT, or Pen. Oil.	7.2.4.1e
VB	Final shell-to-bottom weld, as alternative to requirements of 7.2.4.1 or 7.2.4.2 either side of the finished joint if not MT or PT tested.	7.2.4.3c
VB	Bottom welds if not tested to 7.3.3b or 7.3.3c	7.3.3a
VB	Welds of roofs designed to be gas-tight if not air tested.	7.3.8.1
VB	Compartment welds of external floating roofs if not tested with internal pressure or penetrating oil.	C.3.6
VB	Seams of flexible membrane liners for leak protection.	I.6.2

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Process	Welds Requiring Inspection	Reference Section
VB	Welded shell joints if no water is available, if not air tested or tested to 7.3.6, Item 2) a) i) or 7.3.6, Item 2) a) iii).	7.3.6, Item 2) a) ii)
VB	Welded shell joints above the hydrostatic test water level unless air-tested or tested to the requirements of 7.3.7.1, Item 1) or 7.3.7.1, Item 3).	7.3.7.1, Item 2)
VE	Flush type shell connections: Nozzle-to-tank shell, repad welds, shell-to-bottom reinforcing pad welds on the root pass, each 20 mm ($^1/_2$ in.) of weld, and completed weld. After stress relieving before hydro-test.	5.7.8.11
VE	Tack of shell butt welds left in place.	7.2.1.9
VE	Non-structural small attachments such as insulation clips (not supports) studs and pins including those welded by capacitor discharge.	7.2.1.12d
VE	Permanent attachment welds and temporary weld removal areas on Group IV, IVA, V, and VI materials.	7.2.3.6
VE	Completed welds of stress relieved assemblies before hydro-test.	7.2.3.7
VE	First pass and final weld inside and outside of the internal shell-to-bottom weld.	7.2.4.1, 7.2.4.2, 7.2.4.3
VE	All shell plate butt welds.	7.3.2.1
VE	All fillet welds.	7.3.2.2
VE	Upper side of the upper deck welds of pontoon and double deck floating roofs.	C.4.4
VE	All aluminum structural welds and components joined by welding.	G.11.3
VE	Joint fit-up of butt welds of bottoms supported by grillage and each weld pass.	I.7.4
VE	Leak barrier, leak barrier penetrations, attachments to ringwalls and other appurtenances.	I.6.1
VE	Bottom welds.	7.3.3
VE	Roof welds not designed to be gas-tight.	7.3.8.2
Water	Bottom welds if not vacuum-box or tracer gas tested.	7.3.3c
Water	External floating roofs—flotation test.	C.4.3
Water	External floating roof drain pipe and hose systems with pressure.	C.4.5
Water	Aluminum dome roofs after completion.	G.10.1.1
Water	Internal floating roofs flotation test.	H.6.6.1

Definitions:

MT = Magnetic Particle Examination

Pen Oil = Penetrating Oil Test

PT = Liquid Penetrant Examination

RT = Radiographic Testing

VB = Vacuum-Box Testing

VE = Visual Examination

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Acceptance Standards:

MT: ASME Section VIII, Appendix 6 (Paragraphs 6-3, 6-4, 6-5)

PT: ASME Section VIII, Appendix 8, (Paragraphs 8-3, 8-4, 8-5)

RT: ASME Section VIII, Paragraph UW-51(b)

Tracer Gas: API Std 650, Section 8.6.11.b

UT: For welds examined by UT in lieu of RT, acceptance standards are in Annex U.6.6. For UT when RT is used for the requirements of 7.3.2.1, the acceptance standard is as agreed upon by the Manufacturer and Purchaser.

VB: API Std 650, Section 8.6.9

VE: API Std 650, Section 8.5.2

Examiner Qualifications:

MT: API Std 650, Section 8.2.3

PT: API Std 650, Section 8.4.3

RT: ASNT SNT-TC-1A or ISO Std 9712 Level II or III. Level-I personnel may be used under the supervision of a Level II or Level III with a written procedure in accordance with ASME Section V, Article 2.

Tracer Gas: None

UT: For welds examined by UT in lieu of RT, the examiner must be ASNT-TC-1A, CP-189, or ISO Std 9712 Level II or Level III per API Std 650 Annex U.4.1. For UT when RT is used for the requirements of 7.3.2.1, the required qualifications are ASNT-TC-1A or ISO Std 9712 Level II or Level III. A Level I may be used with restrictions, see API Std 650, Section 8.3.2.

VE: API Std 650, Section 8.5.1

VB: API Std 650, Section 8.6.4

Procedure Requirements:

MT: ASME Section V, Article 7

PT: ASME Section V, Article 6

RT: A procedure is not required. However, the examination method must comply with ASME Section V, Article 2. Acceptance standards shall be in accordance with ASME Section VIII, Paragraph UW-51(b).

UT: For shell welds examined by UT in lieu of RT, ASME, Section V, Article 4 and API Std 650 Annex U.3.5. For welds when RT is used for the requirements of 7.3.2.1, ASME Section V.

VB: API Std 650, Sections 8.6.2, 8.6.5, 8.6.6, 8.6.7, and 8.6.8

VE: None

Tracer Gas: API Std 650, Section 8.6.11.a

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