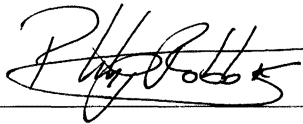
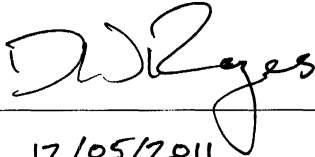


**REVISS Services
Quality and Regulatory Group**

Technical Memorandum

**R7021 Transport Container
Design Justification**

Author:		Reviewer:	
Name	P J G Robbins	Name	D W Rogers
Signature		Signature	
Date	12/05/11	Date	12/05/2011

1. PURPOSE AND SCOPE

This document details the changes to the R7021 transport container manufacturing drawings from the prototype onwards and justifies them with respect to the IAEA requirements for Type B(U) packaging as specified in TS-R-1, i.e. the thermal, shielding, containment and mechanical performance of the design.

2. DESCRIPTION

The design consists of a shielded, stainless steel flask mounted on a pallet and protected from heat and impact by a jacket and top shield (Figure 1). The maximum gross weight is 4,600 kg.

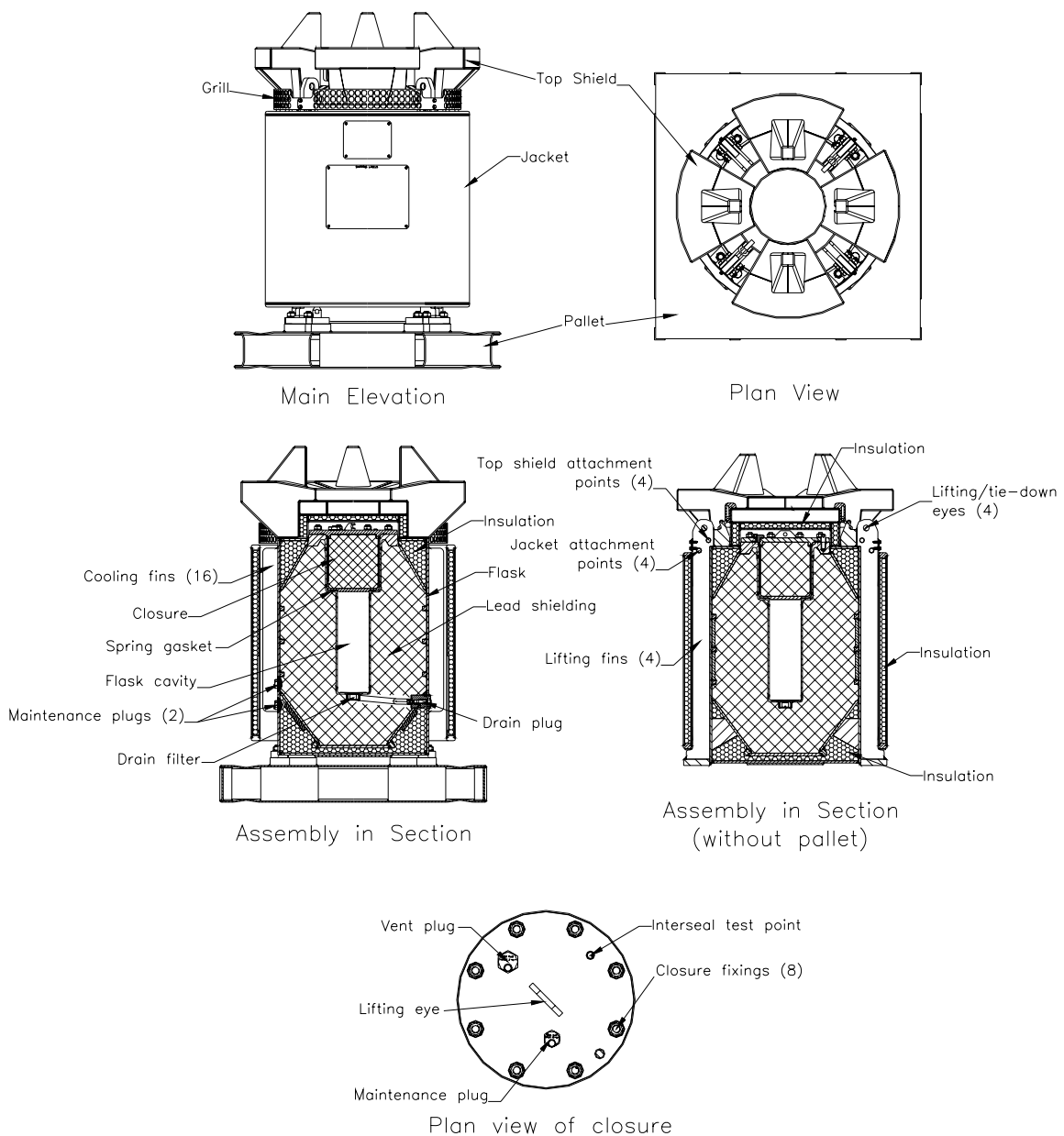


Figure 1: R7021 Assembly

3. ASSESSMENT

3.1 CHANGES FROM DRAWINGS LIST ISSUE 2 TO ISSUE 3

3.1.1 Pallet - R7021/004 issue C

Ref.	Change	Reason	Justification
3.1.1.1	Lateral folds added to upper and lower plates (items 1 & 14).	To give similar energy absorption in both axis.	See report C15578/TR/0001.
3.1.1.2	Projections on ends of channels (items 5) removed.	No value during impact.	
3.1.1.3	Thread size for dowel holes (in items 8) increased to M30, counterbore depth increased by 21mm and diameter reduced by 4mm.	To better support dowels.	
3.1.1.4	All fillet welds increased to 5mm.	To eliminate weld failure during drop testing.	
3.1.1.5	Fillet welds removed from central sections of outer channels (items 6) and inner ends of centre channels (items 10).	To improve welding access.	
3.1.1.6	Centre channels (items 10) no longer continuous between folds on upper and lower plates.	To provide more consistent energy absorption.	
3.1.1.7	Full penetration welds added top and bottom between components of each centre channel (items 10).	To minimise the risk of weld failure during drop testing.	
3.1.1.8	Items 12 added.	To fill in holes required when folding upper and lower plates.	
3.1.1.9	Weight reduced by 4kg.	Result of other changes.	
3.1.1.10	Item 13 added and marking details (note 4) changed to engraving.	Label replaces stamping on prototype for better control of marking.	Label has no effect on thermal, shielding, containment or mechanical performance.
3.1.1.11	Plan view added.	For clarity, to define unwelded lengths of outer channels (see 3.1.1.5).	Pictorial changes only.
3.1.1.12	Reference dimension (450) added for items 3.	For clarity.	
3.1.1.13	Lower plate becomes item 14.	For clarity.	
3.1.1.14	Paint specification reinstated.	To replace simplified specification on prototype.	Finish has no effect on thermal, shielding, containment or mechanical performance.

3.1.2 Top Shield - R7021/005 issue C

Ref.	Change	Reason	Justification
3.1.2.1	Outer diameter of component increased by 60mm.	For increased energy absorption.	See report C15578/TR/0001.
3.1.2.2	Height of cones (items 25 & 26) increased by 15mm. Reference dimensions amended.	For increased energy absorption.	

Ref.	Change	Reason	Justification
3.1.2.3	Length and width of cone caps (items 27) increased by 10mm. Reference dimensions amended.	For smoother energy absorption.	
3.1.2.4	Angle of outer cone face to vertical reduced by 2°. Reference dimensions amended.	To accommodate increased height (ref. 3.1.2.2).	
3.1.2.5	Height of outer face (items 13) reduced by 30mm.	To accommodate increase in outer diameter (ref. 3.1.2.1).	
3.1.2.6	Angle of items 10 to vertical reduced by 1.2°.	To accommodate increased height to items 14 caused by ref. 3.1.2.5.	
3.1.2.7	Items 3-6 removed and items 29-32 added.	To improve punch and drop test performance.	
3.1.2.8	Intermittent fillet welds around webs (items 16) changed to continuous both sides.	To eliminate weld failure during drop testing.	
3.1.2.9	Weld between items 12 & 13 becomes full thickness fillet.	To eliminate weld failure during drop testing.	
3.1.2.10	All fillet welds except to lifting points (items 20) increased to 6mm.	To eliminate weld failure during drop testing.	
3.1.2.11	Weight increased by 11kg.	Result of other changes.	
3.1.2.12	Item 23 moved to side view and item 27 becomes item 28.	For clarity and correction of error.	Pictorial change only.
3.1.2.13	Note 5 removed and st/st 304L added to materials box.	To better specify material grade.	No change to material specification.
3.1.2.14	Item 21 added and marking details (note 7) changed to engraving.	Label replaces stamping on prototype for clearer marking.	No effect on thermal, shielding, containment or mechanical performance.
3.1.2.15	Item 19 quantity reduced to 4 and item 33 quantity 4 added.	Correction of error.	Change to part numbering only.
3.1.2.16	Supplier details added to note 8.	For information.	No change to part specification.
3.1.2.17	Item 23 becomes stainless steel.	To realise original design intent.	No effect on thermal, shielding, containment or mechanical performance.
3.1.2.18	Paint specification reinstated.	To replace simplified specification on prototype.	No effect on thermal, shielding, containment or mechanical performance.
3.1.2.19	Outer diameter of item 8 and inner diameter of item 2 become 506mm and item numbers added to dimensions.	To rationalise dimensions and for clarity.	No change to design.
3.1.2.21	Angle 32° added to items 25 & 26.	To allow cone to be developed.	
3.1.2.22	Dimension 123/127 added to items 25 & 26.	To position cones.	

3.1.3 Jacket - R7021/006 issue C

Ref.	Change	Reason	Justification
3.1.3.1	Items 13 added, along with section F-F for positioning.	To reduce punch penetration near drain point.	See report C15578/TR/0001.
3.1.3.2	Weight increased by 17kg.	Result of other change.	
3.1.3.3	NDT2 (radiography – note 1) added to seam welds in inner (item 3) and outer (item 2) surfaces.	For improved weld assurance.	No change to design.
3.1.3.7	Angular position of seam welds in items 2 & 3 and joins in items 9 added.	For clarity.	
3.1.3.4	Item 12 added and marking details (note 8) changed to engraving.	Label replaces stamping on prototype for clearer marking.	No effect on thermal, shielding, containment or mechanical performance.
3.1.3.5	Weld preparation between items 9 & 2 and 9 & 3 becomes single-V.	For optimum welding access.	No effect on thermal, shielding, containment or mechanical performance.
3.1.3.6	Distance to item 9 weld root from top of component increased to 17mm.	To maintain clearance between the edge of the weld and radius.	
3.1.3.8	Angular tolerance relaxed for positioning items 8.	Over-specified.	No effect on thermal, shielding, containment or mechanical performance.
3.1.3.10	Weld of items 6 & 7 increased to 6mm.	For ease of manufacture and robustness.	
3.1.3.9	Paint specification reinstated.	To replace simplified specification on prototype.	No effect on thermal, shielding, containment or mechanical performance.

3.2 CHANGES FROM DRAWINGS LIST ISSUE 3 TO ISSUE 4

3.2.1 R7021 Container Assembly - R7021/001 issue C

Ref.	Change	Reason	Justification
3.2.1.1	Material of O-rings (items 28, 30 & 32) becomes FKM V1289-75.	For required performance.	See RTM 126.
3.2.1.2	Cross-section of O-rings (items 30, 31 & 32) increased by 0.22mm.	To allow use of new material.	
3.2.1.3	Maintenance plugs (items 40) and O-rings (items 41 & 42) added, along with leak-testing of containment boundary (note 4A).	Requirement for production design.	
3.2.1.4	Item 12 becomes M30 dowel and material becomes c/st.	To reflect revised design.	See 3.2.11.
3.2.1.5	Items 13, 14, 18 & 24 reinstated.	Omitted from prototype for test purposes.	No effect on thermal, shielding, containment or mechanical performance.
3.2.1.6	Item 26 quantity increased to 6.	To protect interseal test points in maintenance plugs.	
3.2.1.7	Item 33 removed and quantity of item 30 becomes 2.	Rationalisation of O-rings.	
3.2.1.8	Item 16 finish becomes cadmium plate.	Omitted from prototype for test purposes.	No change to design.
3.2.1.9	Weighing requirement added to note 1.	To ensure compliance.	
3.2.1.10	Reference height becomes 1685 and reference diameter becomes 1060.	To reflect new top shield design.	See report C15578/TR/0001.
3.2.1.11	Stud (item 27) used for plugging temporary leak-test port removed.	No longer required.	Change has no effect on thermal, shielding, containment or mechanical performance.
3.2.1.12	Section A-A and drain plug detail added.	For clarity.	Pictorial change only.
3.2.1.13	Calculated weight (4390 kg) replaces measured weight (note 2).	To update data.	Changes affecting weight justified elsewhere in this document.
3.2.1.14	Supplier details added to note 5.	For information.	No change to part specification.

3.2.2 Body - R7021/002 issue C

Ref.	Change	Reason	Justification
3.2.2.1	Lifting fin (items 11) chamfers lengthened to 1050mm.	To remove sharp edges.	See report C15578/TR/0001.
3.2.2.2	Edge radius added to fins (items 7).		
3.2.2.3	Lifting fin (items 11) fillet welds increased to 10mm.	To improve strength and thermal conductivity.	
3.2.2.4	Items 27 added.	To better secure lead.	
3.2.2.5	Additional item 8 added.	For ease of manufacture.	
3.2.2.6	Feet (items 12) welds increased to 10mm fillet.	To maximise strength of joint.	
3.2.2.7	Minimum stainless steel properties added (note 11).	To bring into line with modelling.	
3.2.2.8	Weld between items 14 & 18	To allow a more	

Ref.	Change	Reason	Justification
	moved and becomes full penetration single V-butt.	consistent weld to be made and tested.	
3.2.2.9	Welds between cones (items 4 & 5) and outer wall (item 1) increased to 12mm fillet.	To maximise strength.	
3.2.2.10	Welds between feet (items 12) and lifting fins (items 11) changed to bevel-butt beneath 10mm fillet.		
3.2.2.11	Items 14, 18, 19, 20, & 21 modified.	To allow UT inspection, remove sharp corners, return depth of closure counterbore and cavity to original dimensions and increase strength of connection to item 14.	
3.2.2.12	Items 4 to 14 register reduced.	To ensure full penetration.	
3.2.2.13	Drain tube assembly (item 29) replaces items 16, 17 & 22. Note 9 item numbers updated.	To better represent manufacturing process.	
3.2.2.14	Item 23 details modified.	To suit new drain tube assembly.	
3.2.2.15	Item 29 to 21 welds enlarged.	To maximise strength of joint.	
3.2.2.16	Major revision to item 29.	To provide annulus around drain tube, improve thermal connection to item 5 and reduce projection outside item 1.	
3.2.2.17	Calculated weight (3418 kg) replaces measured weight (note 2).	To update data.	
3.2.2.18	Fin (items 7) welds increased to 5mm.	To maximise thermal conduction.	See RTM 120.
3.2.2.19	Tie-down holes in lifting fins (items 11) increased to 30mm diameter.	To reduce tie-down contact stress.	See RTM 122.
3.2.2.20	Items 28 added.	To provide leak-test points.	See RTM 126.
3.2.2.21	Register in cavity base (item 21) increased in diameter by 10mm.	To accommodate item 29.	Changes have no effect on thermal, shielding, containment or mechanical performance.
3.2.2.22	Item 10 fillet weld increased to 5mm.	For ease of welding.	
3.2.2.23	Seam weld in item 1 moved 90°.	To avoid test points.	
3.2.2.24	UT inspection added to note 1 and welds in items 1, 3, 5, 9, 13 & 14. Items 14, 19, 21 & 23 increased in thickness to allow for UT inspection.	For improved assurance.	
3.2.2.25	Weld between items 9 & 13 becomes a single-V.	For ease of manufacture.	
3.2.2.26	Angle of dish on item 21 becomes 2.1/1.9°.	To better control angle.	
3.2.2.27	Item 24 added and marking details (note 7) changed to engraving.	Label replaces stamping on prototype for clearer	No effect on thermal, shielding, containment or

Ref.	Change	Reason	Justification
		marking.	mechanical performance.
3.2.2.28	St/st now to BS EN 10088.	For clarity.	No change to design.
3.2.2.29	Fin radius (20mm) added.	To correct omission.	
3.2.2.30	Finish now refers to note 3.	For clarity.	
3.2.2.31	Note 10 added.	To avoid risk of container being overweight.	
3.2.2.32	Reference to BS2779 (note 6) deleted.	No longer required.	
3.2.2.33	Item 8 to 1 weld updated.	Correction of error.	
3.2.2.34	Depth of item 14 from item 3 changed to 25.1/24.9mm, thickness of item 21 changed to 8.2/7.8mm, depth from item 19 to item 21, 482.2/481.8mm, and depth from item 19 to item 14, 217.1/216.8mm, added. Thickness of item 19 (8mm) and projection of item 14 (20mm) become reference.	To better control build-up of tolerances.	
3.2.2.35	View M added.	To show test points.	Pictorial change only.
3.2.2.36	Part-fabrication details added.	For ease of manufacture.	

3.2.3 Closure - R7021/003 issue C

Ref.	Change	Reason	Justification
3.2.3.1	Section E-E added.	To provide test point for containment boundary.	No effect on thermal, shielding, containment or mechanical performance.
3.2.3.2	4mm diameter hole added to lifting point (item 4).	To enable test point plug to be wired.	
3.2.3.3	Item 1 to 6 weld preparation modified.	To improve access.	
3.2.3.4	UT inspection added to note 1 and welds in items 1, 2 & 6. Item 2 increased in thickness to allow for UT inspection. Item 6 adjusted to compensate. Section E-E weld preparation also modified.	For improved assurance.	
3.2.3.5	Item 7 added and marking details (note 5) changed to engraving.	Label replaces stamping on prototype for clearer marking.	No effect on thermal, shielding, containment or mechanical performance.
3.2.3.6	St/st now to BS EN 10088.	For clarity.	No change to design.
3.2.3.7	Finish now refers to note 3.	For clarity.	
3.2.3.8	Items 3, 9, 10 & 11 deleted.	No longer necessary.	See report C15578/TR/0001.
3.2.3.9	Calculated weight (156 kg) replaces measured weight (note 2).	To update data.	
3.2.3.10	Minimum stainless steel properties added (note 11).	To bring into line with modelling.	
3.2.3.11	Depth dimension and final thickness of base of item 2 revert to issue A values.	To re-balance shielding.	
3.2.3.12	Half section titles and shrinkage warning note added.	For clarity.	Pictorial change only.

3.2.4 Pallet - R7021/004 issue D

Ref.	Change	Reason	Justification
3.2.4.1	Finish becomes galvanising.	Access for painting restricted due to items 16.	No effect on thermal, shielding, containment or mechanical performance.
3.2.4.2	Items 16 and associated details added.	To provide structural support to channel sections.	See report C15578/TR/0001.
3.2.4.3	Calculated weight becomes 240 kg (note 2). Engraved weight is 248kg.	To reflect changes. Weight includes studs and dowels.	
3.2.4.4	Minimum c/st properties added to note 3.	To ensure adequate strength and ductility.	
3.2.4.5	Dimensions of central channels reduced to 33.5/31.5mm & 18.5/16.5mm.	To bring centre of effort of flask feet more centrally over channels in upright drop test.	

3.2.5 Top Shield - R7021/005 issue D

Ref.	Change	Reason	Justification
3.2.5.1	Minimum st/st properties added to note 5.	To ensure adequate strength and ductility.	See report C15578/TR/0001.
3.2.5.2	Minimum c/st properties added to note 6.	To ensure adequate strength and ductility.	
3.2.5.3	Paint specification changed to SS023.	Correction of error.	No change to design.

3.2.6 Jacket - R7021/006 issue D

Ref.	Change	Reason	Justification
3.2.6.1	Minimum st/st properties added to note 3.	To ensure materials are of sufficient strength and ductility.	See report C15578/TR/0001.
3.2.6.2	Minimum c/st properties added to note 4.	To ensure materials are of sufficient strength and ductility.	
3.2.6.3	Paint specification changed to SS023.	Correction of error.	No change to design.

3.2.7 Drain Plug - R7021/008 issue B

Ref.	Change	Reason	Justification
3.2.7.1	Overall length increased.	To locate main seal deeper within container.	See RTM 120.
3.2.7.2	Increased depth of tap drill hole.	To minimise conduction of heat along plug.	
3.2.7.3	Change in seal groove dimensions.	To accommodate imperial seal sizes.	See RTM 126.
3.2.7.4	Backup seal changed to chamfer-type.	For ease of manufacture.	No effect on thermal, shielding, containment or mechanical performance.
3.2.7.5	Engraving added to head of plug.	For operator information.	

3.2.8 Vent Plug - R7021/009 issue B

Ref.	Change	Reason	Justification
3.2.8.1	Change in seal groove dimensions.	To accommodate imperial seal sizes.	See RTM 126.
3.2.8.2	Hex head angle 60° added.	For clarity.	No change to design.
3.2.8.3	Thread standard now to ISO 228.		
3.2.8.4	Material specification changed to 300 series st/st.		
3.2.8.5	Engraving added to head of plug.	For operator information.	No effect on thermal, shielding, containment or mechanical performance.

3.2.9 M20 Stud - R7021/011 issue C

Ref.	Change	Reason	Justification
3.2.9.1	Material grade changed to A2-80 or A4-80.	Lower grade used on prototype for test purposes.	See report C15578/TR/0001.
3.2.9.2	Calculated weight 0.2kg added.	For information.	No change to design.
3.2.9.3	Engraving updated.	To reflect new issue status.	

3.2.10 M24 Stud - R7021/012 issue C

Ref.	Change	Reason	Justification
3.2.10.1	Thread length increased to 40mm and overall length increased to 99mm.	To allow stud to engage with pallet top plate.	See report C15578/TR/0001.
3.2.10.2	Calculated weight 0.4kg added.	For information.	No change to design.
3.2.10.3	Engraving updated.	To reflect new issue status.	

3.2.11 M30 Dowel - R7021/013 issue B

Ref.	Change	Reason	Justification
3.2.11.1	Thread size increased to M30. Undercut diameter becomes 25.5/25.3mm and thread chamfer becomes 2.5mm x 45°.	To maximise strength.	See report C15578/TR/0001.
3.2.11.2	OD changed to 39.8/39.7mm.	To improve fit in pallet counterbore.	
3.2.11.3	Body length changed to 91mm and length to flats changed to 71mm.	To increase depth of engagement with counterbore.	
3.2.11.4	Lengths of threaded portion become 15.5mm and 6mm.	To maintain overall engagement depth of dowel.	
3.2.11.5	Material changed to c/st grade 8.8. Finish becomes cadmium plate and passivate.	For increased strength.	
3.2.11.6	Calculated weight 1.1kg added.	For information.	No change to design.

3.2.12 Identity Plate - R7021/015 issue B

Ref.	Change	Reason	Justification
3.2.12.1	Maximum gross weight becomes 4600kg.	To reflect new maximum design weight.	See report C15578/TR/0001.
3.2.12.2	Assembly net weight and jacket weight removed.	For simplicity.	No change to design.
3.2.12.3	Note 2 NN changed to XX.	To bring into line with similar drawings.	

3.2.13 M16 Shoulder Bolt - R7021/016 issue C

Ref.	Change	Reason	Justification
3.2.13.1	Minimum c/st properties added to note 1.	To ensure adequate strength and ductility.	See report C15578/TR/0001.
3.2.13.2	Reference to manufacture from M10 x 100mm bolt removed.	To allow manufacture from bar stock.	No change to design.
3.2.13.3	Plain portion diameter 20.1/19.9mm, head depth 13mm, across flats width 30.0/29.8mm and hex head angle 60° added.		
3.2.13.4	Finish changed to cadmium plate and passivate.	Omitted from prototype for test purposes.	No effect on thermal, shielding, containment or mechanical performance.

3.2.14 Drain Filter - R7021/017 issue B

Ref.	Change	Reason	Justification
3.2.14.1	Components detailed separately.	For clarity.	No change to design.
3.2.14.2	Overall height increased.	To allow for increased depth of well due to drain to drain tube sleeve.	No effect on thermal, shielding, containment or mechanical performance.

3.2.15 1/8" BSP Maintenance Plug - R7021/019 issue A

Ref.	Change	Reason	Justification
3.2.15.1	New drawing.	New requirement.	No effect on thermal, shielding, containment or mechanical performance.

3.2.16 Drain Tube Assembly - R7021/020 issue A

Ref.	Change	Reason	Justification
3.2.16.1	New sub-assembly drawing created from details previously on body, R7021/002.	To better suit manufacturing process.	No change to design.
3.2.16.2	Design modified.	To incorporate drain tube sleeve, interspace leak-test point, improved NDT and leak-testing.	See report C15578/TR/0001.

3.2.17 Boss - R7021/021 issue A

Ref.	Change	Reason	Justification
3.2.17.1	New drawing created from details previously on body, R7021/002.	To better suit manufacturing process.	No change to design.
3.2.17.2	Design modified.	To incorporate drain tube sleeve, radiography of drain tube joint, interspace leak-test point, longer drain plug (with imperial seals), to update thread standard and to minimise protrusion of plug head.	See report C15578/TR/0001.

3.2.18 Well - R7021/022 issue A

Ref.	Change	Reason	Justification
3.2.18.1	New drawing created from details previously on body, R7021/002.	To better suit manufacturing process.	No change to design.
3.2.18.2	Design modified.	For drain tube sleeve and radiography of drain tube joint.	See report C15578/TR/0001.

3.2.19 Outer Tube - R7021/023 issue A

Ref.	Change	Reason	Justification
3.2.19.1	New drawing.	To protect drain tube from lead movement.	See report C15578/TR/0001.

3.2.20 Drain Tube - R7021/024 issue A

Ref.	Change	Reason	Justification
3.2.20.1	New drawing created from details previously on body, R7021/002.	To better suit manufacturing process.	No change to design.
3.2.20.2	Design modified.	To allow radiography of joints.	See report C15578/TR/0001.

3.2.21 Sheath - R7021/025 issue A

Ref.	Change	Reason	Justification
3.2.21.1	New drawing.	To protect drain tube from lead movement.	See report C15578/TR/0001.

3.2.22 Plug - R7021/026 issue A

Ref.	Change	Reason	Justification
3.2.22.1	New drawing.	Allows inside of drain tube to be machined after welding.	No effect on thermal, shielding, containment or mechanical performance.

3.2.23 Filter Body - R7021/027 issue A

Ref.	Change	Reason	Justification
3.2.23.1	New drawing created from details previously on drain filter, R7021/017.	For clarity.	No change to design.
3.2.23.2	Height increased.	To allow for increased depth of well due to drain tube sleeve.	No effect on thermal, shielding, containment or mechanical performance.

3.2.24 Backing Ring - R7021/028 issue A

Ref.	Change	Reason	Justification
3.2.24.1	New drawing created from details previously on drain filter, R7021/017.	For clarity.	No change to design.

3.2.25 Washer - R7021/029 issue A

Ref.	Change	Reason	Justification
3.2.25.1	New drawing created from details previously on drain filter, R7021/017.	For clarity.	No change to design.

3.2.26 Mesh - R7021/030 issue A

Ref.	Change	Reason	Justification
3.2.26.1	New drawing created from details previously on drain filter, R7021/017.	For clarity.	No change to design.

3.3 CHANGES FROM DRAWINGS LIST ISSUE 4 TO ISSUE 5

3.3.1 R7021 Container Assembly - R7021/001 issue D

Ref.	Change	Reason	Justification
3.3.1.1	Item 18 becomes M8 x 10 skt pan hd screw. Quantity of item 23 becomes 24. Item 24 removed.	Correction of error. Thread size mismatch between fasteners and label holes on jacket.	Change has no effect on thermal, shielding, containment or mechanical performance.
3.3.1.2	Note 6 added.	Correction of omission.	No change to design.
3.3.1.3	Item 20 specification becomes to BS EN ISO 3506-2.	Correction of error.	

3.3.2 Body - R7021/002 issue D

Ref.	Change	Reason	Justification
3.3.2.1	Diameter of spring gasket recess in item 19 becomes 232mm.	To accommodate increased outer diameter of spring gasket.	Changes have no effect on thermal, shielding, containment or mechanical performance.
3.3.2.2	Angular dimension on item 14 becomes 65°/55°.	Dimension over-specified.	
3.3.2.3	Note 13 added.	To permit alternative machining processes.	
3.3.2.4	Dimensions of holes through leak-test points (items 28) changed (minimum thread depth becomes 12mm, tap drill max depth becomes 16mm). Diameter 6mm hole added to break through with max drill point 31mm and note 14 added.	Correction of omission. Necessary to maintain cleanliness of shielding and insulation.	
3.3.2.5	External radius (7mm) at the base of items 11 removed.	Unnecessary feature.	316L is compatible with 304L and has identical mechanical and thermal properties. Weld is a back-up for the full penetration weld between these items and as such is not a key structural weld. No change to design.
3.3.2.6	Alternative material grade 1.4404 (316L) added.	For ease of procurement.	
3.3.2.7	NDT2 removed from fillet weld between items 5 & 13.	UT requirement is not essential.	
3.3.2.8	NDT3 (Radiography) added to note 1. NDT2 changed to NDT3 on two welds between items 21 & 29.	Radiography is more appropriate for the material geometry and thickness.	
3.3.2.9	NDT3 added to welds between items 4 & 1 and items 5 & 1.	Radiography is needed to cover volumetric and horizontal side wall defects.	
3.3.2.10	NDT2 removed from weld between items 11 & 12.	UT not practicable.	
3.3.2.11	NDT2 changed to NDT3 for item 18 seam weld and welds between items 14 & 18, 18 & 19, 19 & 20, and 20 & 21.	UT not practicable for all circumferential welds.	

Ref.	Change	Reason	Justification
3.3.2.12	Note 11 removed.	Redundant information. Minimum properties for 304L in BS EN 10088 are the same as those specified.	
3.3.2.13	Note 12 added specifying coupon for welds between items 21 and 29.	Not practicable to inspect root of welds using volumetric NDT.	
3.3.2.14	Dimension 28mm (position of chamfer on item 18) removed.	Insufficient raw material thickness in item 18 to accommodate chamfer.	No effect on structural strength or shielding. Wall thickness maintained at junction with main flange and transition remains well clear of junction.
3.3.2.15	Spotface added to diameter 30 holes on items 12 (diameter 51/49mm, depth such that thickness under spotface is 31/28mm).	To ensure flask securing nuts are tightened onto a flat and perpendicular surface. Eliminates sensitivity of design to distortion of feet from welding.	No change to net thickness of feet, hence no change to shear area. Thus mechanical performance is not affected.
3.3.2.16	10mm radius on item 19 moved to corner of machined rebate.	Correction of error.	Pictorial change only.

3.3.3 Closure - R7021/003 issue D

Ref.	Change	Reason	Justification
3.3.3.1	Alternative material grade 1.4404 (316L) added.	For ease of procurement.	316L is compatible with 304L and has identical mechanical and thermal properties.
3.3.3.2	Note 6 removed.	Redundant information. Minimum properties for 304L in BS EN 10088 are the same as those specified.	No change to design.
3.3.3.3	Note 7 added.	To permit alternative machining processes.	No effect on thermal, shielding, containment or mechanical performance.
3.3.3.4	Dimensions of hole through leak-test point (section E-E) changed (minimum thread depth becomes 12mm, tap drill max depth becomes 16mm). Diameter 6mm hole added to break through with max drill point 32mm and note 8 added.	Correction of omission. Necessary to maintain cleanliness of shielding and insulation.	
3.3.3.5	Section showing seam weld through item 6 becomes F-F.	Correction of error. Section E-E already details leak-test point.	Pictorial change only.

3.3.4 Pallet - R7021/004 issue E

Ref.	Change	Reason	Justification
3.3.4.1	C/st yield strength becomes 400 N/mm ² (note 3).	To reflect modelled properties.	See report C15578/TR/0001.
3.3.4.2	Galvanising omitted from counterbores on items 8.	Not practicable to maintain tolerance on diameter.	No effect on thermal, shielding, containment or mechanical performance.
3.3.4.3	Alternative material grade (P460NL1/2 to EN 10028-3) added to note 3.	For ease of procurement.	Chemical and mechanical properties comply fully with drawing requirements.

3.3.5 Top Shield - R7021/005 issue E

Ref.	Change	Reason	Justification
3.3.5.1	C/st yield strength becomes 400 N/mm ² (note 3).	To reflect modelled properties.	See report C15578/TR/0001.
3.3.5.2	Alternative material grade (P460NL1/2 to EN 10028-3) added to note 3.	For ease of procurement.	Chemical and mechanical properties comply fully with drawing requirements.
3.3.5.3	Item 19 becomes item 20 in note 3	Correction of error.	No change to design.
3.3.5.4	Minimum stainless steel requirements and 'or equivalent' removed from note 5.	Redundant information. Minimum properties for 304L (1.4307) in BS EN 10088 are the same as those specified.	No change to design.

3.3.6 Jacket - R7021/006 issue E

Ref.	Change	Reason	Justification
3.3.6.1	C/st yield strength becomes 400 N/mm ² (note 3).	To reflect modelled properties.	See report C15578/TR/0001.
3.3.6.2	Alternative material grade (P460NL1/2 to EN 10028-3) added to note 3.	For ease of procurement.	Chemical and mechanical properties comply fully with drawing requirements.
3.3.6.3	Note 10 added.	Flush weld finish only required opposite lifting fins.	No reduction in strength of weld and no difference to the weight.
3.3.6.4	Dimension 24°/0° and 10° added positioning items 10.	To give more flexibility during manufacture.	No effect on thermal, shielding, containment or mechanical performance.
3.3.6.5	Minimum stainless steel requirements and 'or equivalent' removed from note 3.	Redundant information. Minimum properties for 304L (1.4307) in BS EN 10088 are the same as those specified.	No change to design.

3.3.7 Drain Plug - R7021/008 issue C

Ref.	Change	Reason	Justification
3.3.7.1	Diameter 13.4 becomes 13.45/13.25.	To ensure clearance between the plug and boss when assembled.	No effect on thermal, shielding, containment or mechanical performance.

3.3.8 M24 Stud - R7021/012 issue D

Ref.	Change	Reason	Justification
3.3.8.1	Charpy V-notch impact requirement added (note 4).	Correction of omission.	No change to design.
3.3.8.2	Marking updated.	To reflect new issue level.	

3.3.9 M30 Dowel - R7021/013 issue C

Ref.	Change	Reason	Justification
3.3.9.1	Charpy V-notch impact requirement added (note 3).	Correction of omission.	No change to design.

3.3.10 Shipping Plate - R7021/014 issue B

Ref.	Change	Reason	Justification
3.3.10.1	Hole diameters become 11/10mm.	Correction of error.	No effect on thermal, shielding, containment or mechanical performance.

3.3.11 Identity Plate - R7021/015 issue C

Ref.	Change	Reason	Justification
3.3.11.1	Hole diameters become 11/10mm.	Correction of error.	No effect on thermal, shielding, containment or mechanical performance.

3.3.12 M16 Shoulder Bolt - R7021/016 issue D

Ref.	Change	Reason	Justification
3.3.12.1	Charpy V-notch impact requirement added (note 1).	Correction of omission.	No change to design.

3.3.13 Spring Gasket - R7021/018 issue B

Ref.	Change	Reason	Justification
3.3.13.1	Marking requirement becomes engraving (note 2).	Engraving is more durable.	No effect on thermal, shielding, containment or mechanical performance.
3.3.13.2	Outer diameter becomes 230mm, diameter of lower, inner edge becomes 227.4mm and angle becomes 8.9°.	To reduce bending stress when compressed and allow margin to yield strength at high temperature.	

3.3.14 1/8" BSP Maintenance Plug - R7021/019 issue B

Ref.	Change	Reason	Justification
3.3.14.1	Diameter 3mm hole becomes diameter 2.2mm. Hole position becomes 18.25mm.	To facilitate manufacture.	No effect on thermal, shielding, containment or mechanical performance.

3.3.15 Drain Tube Assembly - R7021/020 issue B

Ref.	Change	Reason	Justification
3.3.15.1	Alternative material grade 316L added.	For ease of procurement.	316L is compatible with 304L and has identical mechanical properties.
3.3.15.2	NDT1 removed from welds concerning items 3, 5, 6, & 8.	Visual inspection is sufficient to reveal any surface defects that might lead to lead ingress during casting.	Outer sleeve is not required to perform a structural function, just to ensure there is a gap around the inner tube after lead casting.
3.3.15.3	Note 8 added.	For ease of manufacture. Helps to control concentricity during assembly.	Change has no effect on thermal, shielding, containment or mechanical performance.

3.3.16 Boss - R7021/021 issue B

Ref.	Change	Reason	Justification
3.3.16.1	Alternative material grade 1.4404 (316L) added.	For ease of procurement.	316L is compatible with 304L and has identical mechanical properties.
3.3.16.2	Diameter 2.0mm in alternative detail becomes 4.0mm.	Ease of machining. Minimises risk of tool breakage.	Changes have no effect on thermal, shielding, containment or mechanical performance.
3.3.16.3	2mm x 90° countersink added to holes diameter 4.0mm.	Ease of welding.	

3.3.17 Well - R7021/022 issue B

Ref.	Change	Reason	Justification
3.3.17.1	Alternative material grade 1.4404 (316L) added.	For ease of procurement.	316L is compatible with 304L and has identical mechanical properties.

3.3.18 Outer Tube - R7021/023 issue B

Ref.	Change	Reason	Justification
3.3.18.1	Alternative material grade 316L added.	For ease of procurement.	316L is compatible with 304L and has identical mechanical properties.

3.3.19 Drain Tube - R7021/024 issue B

Ref.	Change	Reason	Justification
3.3.19.1	Alternative material grade 316L added.	For ease of procurement.	316L is compatible with 304L and has identical mechanical properties.

3.3.20 Sheath - R7021/025 issue B

Ref.	Change	Reason	Justification
3.3.20.1	Alternative material grade 316L added.	For ease of procurement.	316L is compatible with 304L and has identical mechanical properties.

3.3.20.1	Drawing title becomes 'Sheath'.	'Outer Tube' already in use (R7021/023).	No change to design.
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3.3.21 Plug - R7021/026 issue B

Ref.	Change	Reason	Justification
3.3.21.1	Alternative material grade 1.4404 (316L) added.	For ease of procurement.	316L is compatible with 304L and has identical properties.

3.3.22 Mesh - R7021/030 issue B

Ref.	Change	Reason	Justification
3.3.22.1	'Plain weave' removed from description. Material becomes 304 or 316 st/st. Wire diameter becomes 0.1mm max. Aperture becomes 0.1mm max. Open area becomes 0.3 min. 'Mesh' and 'microns' removed. 'May be part no.' added.	For ease of procurement.	No effect on mechanical performance.

3.4 CHANGES FROM DRAWINGS LIST ISSUE 5 TO ISSUE 6

3.4.1 R7021 Container Assembly - R7021/001 issue E

Ref.	Change	Reason	Justification
3.4.1.1	Reference to note 6 added to items 16 & 19.	Correction of omission.	No change to design..
3.4.1.2	Calculated weight (note 2) becomes 4435kg.	To reflect changes to body.	
3.4.1.3	Breakdown of component weights added to note 2.	For clarity.	

3.4.2 Body - R7021/002 issue E

Ref.	Change	Reason	Justification
3.4.2.1	Items 31 – 36 added.	To improve shielding base and lower radial shielding performance.	See RTM120, RTM124 and RTM168 for details.
3.4.2.2	6 min typ dimension and 3mm fillet weld added to section C-C.	Details position and attachment of item 35.	
3.4.2.3	Diameter 360 and 4mm fillet weld added to detail D.	Details size and attachment of item 36.	
3.4.2.4	Item 6 fillet welds increased to 7mm.	To support additional shielding components.	See RTM168 for details.
3.4.2.5	Views V & Y and sections U-U & Z-Z added.	To permit detailing additional items (see 3.4.2.1).	No change to design.
3.4.2.6	Item 24 weight marking becomes 3475kg.	To reflect addition of items (see 3.4.2.1).	Change has no effect on thermal, shielding, containment or mechanical performance.
3.4.2.7	‘All round’ detail added to bevel-butt weld, detail D.	Correction of omission.	No change to design.
3.4.2.8	Calculated weight becomes 3473kg (note 2).	To reflect addition of items (see 3.4.2.1).	No change to design.
3.4.2.9	Note 11 added.	To give flexibility in manufacturing of item 34.	Change has no effect on thermal, shielding, containment or mechanical performance.

4. CONCLUSIONS

- Issue 4 of the design is justified against the IAEA requirements through modelling and calculation.
- Modifications made between issues 4 and 5 have no adverse effect on the ability of the design to meet the IAEA requirements.
- Modifications made between issues 5 and 6 have no adverse effect on the ability of the design to meet the IAEA requirements.

5. REFERENCES

- C15578/TR/0001 issue 2: Impact assessment of the REVISS R7021 package, AMEC Ltd.
- QS 7021 issue 2: R7021 Transport container drawings list and drawings, REVISS Services (UK) Ltd.
- QS 7021 issue 3: R7021 Transport container drawings list and drawings, REVISS Services (UK) Ltd.
- QS 7021 issue 4: R7021 Transport container drawings list and drawings, REVISS Services (UK) Ltd.
- QS 7021 issue 5: R7021 Transport container drawings list and drawings, REVISS Services (UK) Ltd.
- QS 7021 issue 6: R7021 Transport container drawings list and drawings, REVISS Services (UK) Ltd.
- RTM 120: Thermal performance of the R7021 transport container, REVISS Services (UK) Ltd.
- RTM 122: Performance of the R7021 (GB 3981) transport container under IAEA tie-down loads, REVISS Services (UK) Ltd.
- RTM 124: Shielding performance of the R7021 transport container, REVISS Services (UK) Ltd.
- RTM 126: Justification of the R7021 containment system, REVISS Services (UK) Ltd.
- RTM 168: Performance of the shielding modifications to the R7021 flask in IAEA drop testing, REVISS Services (UK) Ltd.
- TS-R-1: Regulations for the Safe Transport of Radioactive Material, 2005 Edition, IAEA, Vienna.