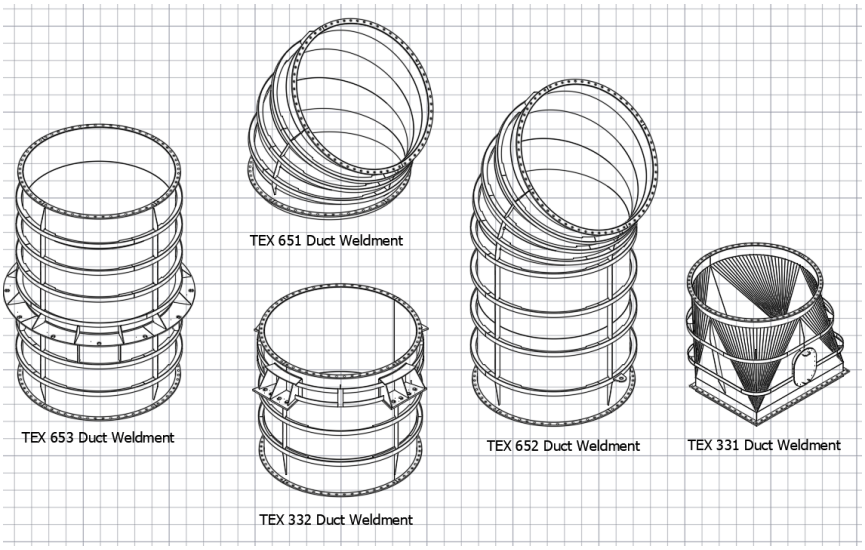
Shadbolt Group

Your Engineering Partner

HMAS CANBERRA-GT Exh.

TEX-331, TEX-332, TEX-651, TEX-652



Customer: Department of Defence - RAN - Royal Australian Navy.

Project: HMAS Canberra - Exhaust Ducts - TEX-331, TEX-332, TEX-651, TEX-652, TEX-653.

Sector: Defence – Ship Building - Sustainment Work.

Project Leaders: Jon Medcalf, Ash Shadbolt, Alan Quadling.

Quality Leaders: Greg Humphrey, Rav Wijeyaratna IWE,

Project Overview:

Shadbolt Group has established a longstanding partnership with the Department of Defence - RAN - Royal Australian Navy, as a prominent provider in the sustainment works at Garden Island Sydney, NSW.

The Department of Defence - Royal Australian Navy engaged Shadbolt Group to construct five new Exhaust segments fabricated to Lloyds Rules. The work scope also included Shadbolt Group working closely with the Department of Defence - Royal Australian Navy to produce detailed shop drawings.

The initial brief was to coordinate and implement an updated design for the GT uptake ducting between the GT module and 2dk.

The scope of works included,

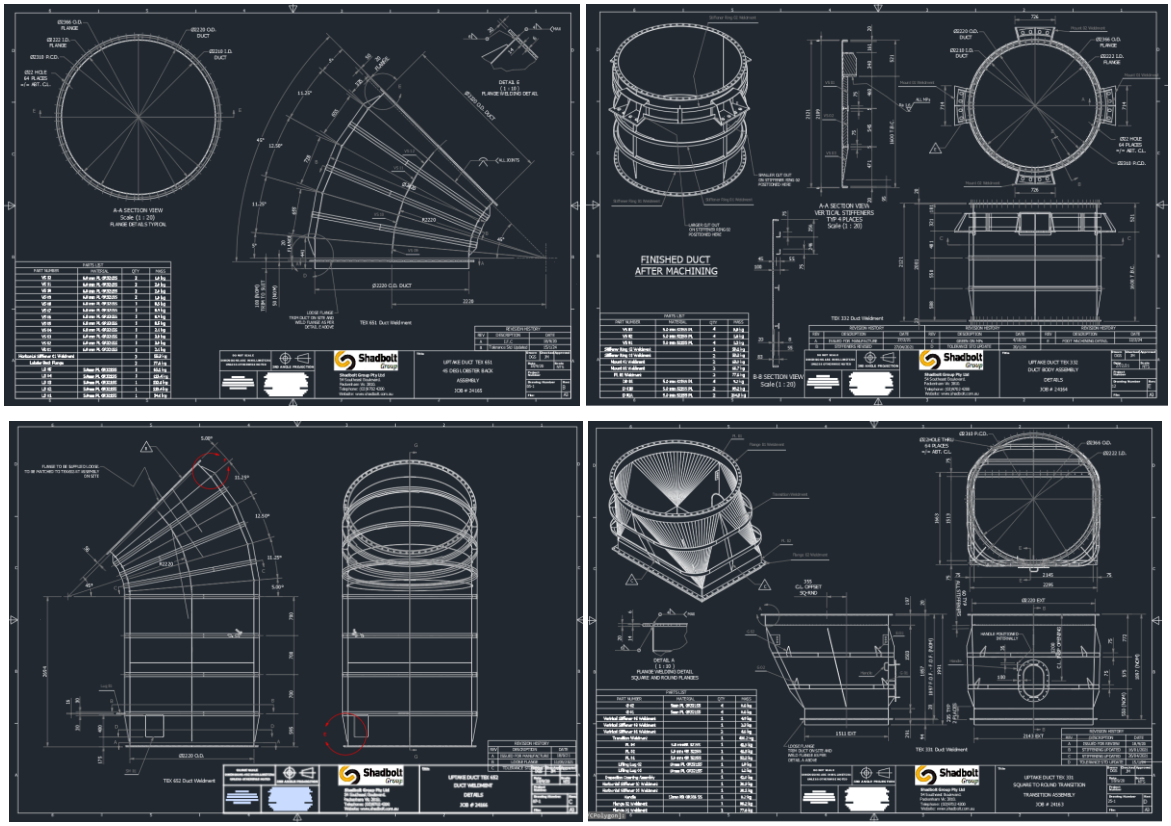
- Duplicating the existing design to include design changes, design improvements as well as producing detailed shop drawing.
- Fabrication of five new stainless steel exhaust duct segments to Lloyds Rules.
- Satisfy the Objective Quality Evidence (OQE).
- Additional work to include the removal of existing and installation of new GT exhaust ducted into HMAS Canberra. Installation details classified.

Shadbolt Group - Fabricated in Pakenham, Melbourne - Installed in Garden Island, Sydney.

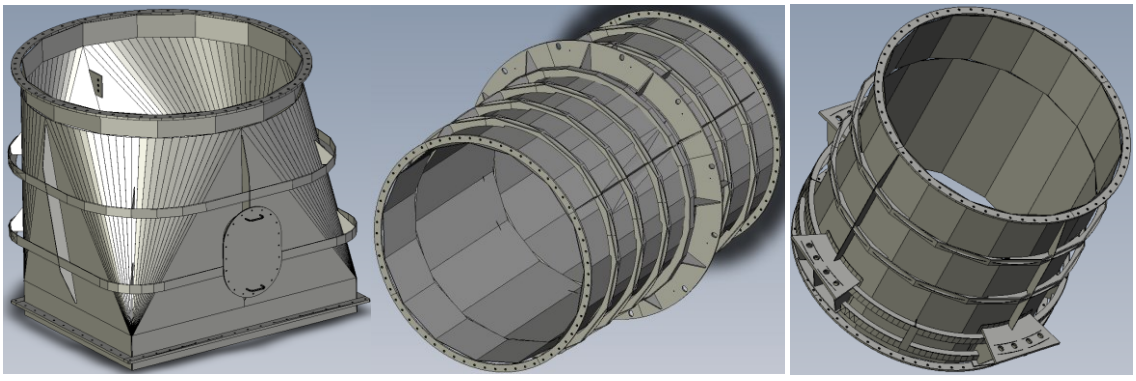
Product Statistics:

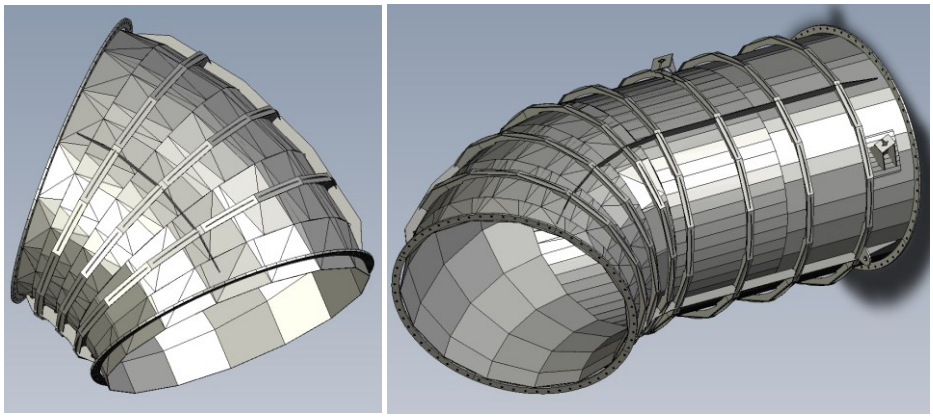
- TEX-331: Ø2220mm x 1897mm - Squire to Round.
- TEX-332: Ø2366mm x 2121mm – Mounting Feet Attached.
- TEX-651: Ø2220mm x 2531mm – Lobster Back.
- TEX-652: Ø2366mm x 5140mm.
- TEX-653: Ø2366mm x 3612mm. Detachable Mounting Feet.
- Material - Stainless Steel – AISI 321 / UNS S32100 / DIN 1.454 - Reinforced with titanium, 321 stainless steel excels in high temperature environments. used in aircraft engines, expansion joints, thermal equipment, refinery equipment, and high temperature chemical processing equipment.

2D - Shop Drawings:



3D - Models:





Processes:

- Procurement. Including local and overseas supply - All Steel purchased and certified to Lloyds 3.1.
- Procure supplementary items including – Gaskets, Stainless Steel Fasteners, Machined subcomponents.
- Sheet Profiling including Waterjet cutting, Laser cutting.
- Sheet Rolling and Folding
- CNC Machining – on individual components prior to fabrication.
- Fange machining to ASME B16.5 (2003) Standard
- Boilermaker - Fabrication
- Welding -
  - Welder Qualifications: AWS D1.6 (2017) & Lloyds Rules Ch 12
  - Welding Consumables - Inspect -ICW PR 018 Storage & Handling of Welding Consumables
  - Welding process – FCAW
  - Welding Technique – Multi Run – BW – FW.
  - Welding Positions – 1G & 2G, 1F & 2F.
  - Total 5 x Weld Procedures Specifications (WPS) Tested and approved by Lloyds Melbourne.
- CNC Machining post fabrication - TEX-332.
- Quality Assurance: Objective Quality Evidence (OQE)

MDR Developed to include -

- ITP, Inspection & Test Plan
- Certificate of Conformance
- Welding Traceability Records
- Material Traceability Register & Certificates
- NDT Records
- Surface Coating Records
- Red Line & As Built Drawings

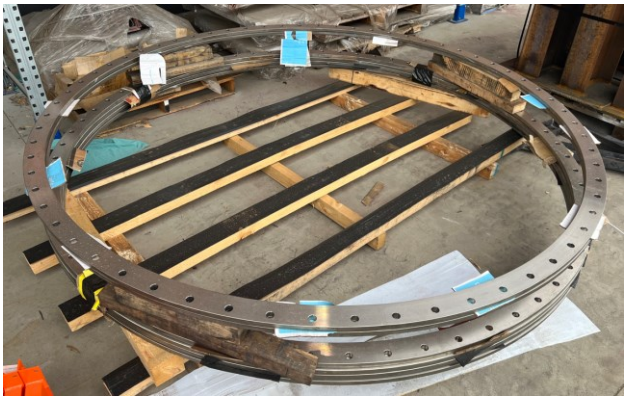
NDT Procedures –

- AS 2062 – 1997 NDT – 100% Penetrant testing of products & components.
- 10% RT of T intersections
  AS 3998 – 2006 – NDT Qualification & certification of personnel. NDT Carried out by independent authorized authority.
- Dimensional checking using a combination of 3D Scanning / 3D probing – validated and reported to ISO-13920-2023 – Welding -General tolerances for welded constructions.
- Surface conditioning - Glass bead blast external surfaces only. Internal weld seams chemically pickled.
- Final Packaging – including customized pallets – securing and shrink wrapping.

The Build:

Material Purchased - Plate Stainless Steel – AISI 321 / UNS S32100 / DIN 1.454 purchased to cut size ready for profiling.

Stainless Steel – AISI 321 support flanges fabricated and machined.



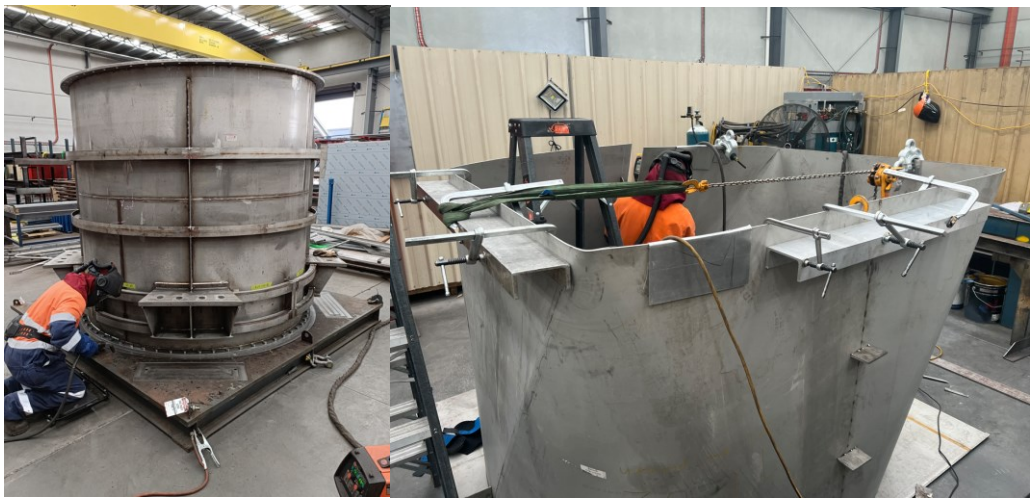
Profiles taking shape.



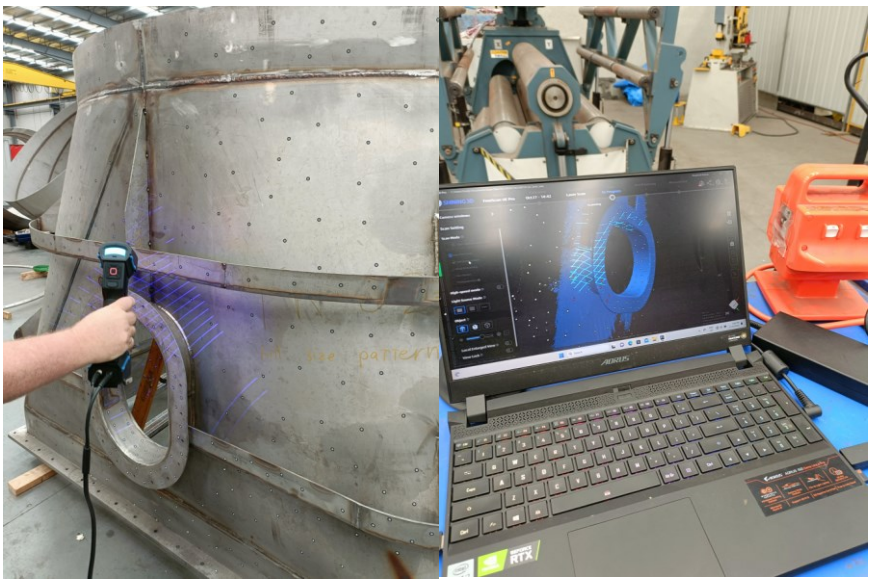
Adding the stiffener rings.




Within the fabrication stage of the build a strong emphasis was placed on the design tolerances. Due to the size of the Ducts and the tight tolerance to ISO-13920-2023 individual parts of the build were strategically welded in a controlled sequence. Particularly over the flange-to-flange distance to achive both the linear and flatness tolerance required.



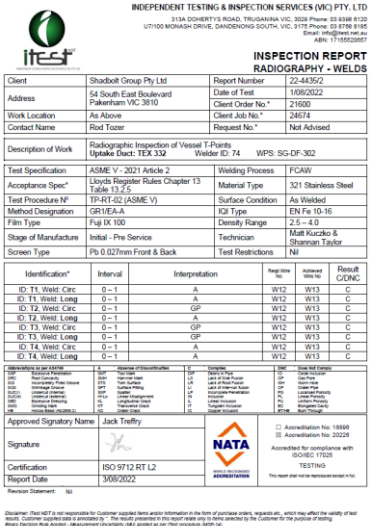
Shadbolt Group validated a number of sections within the tack-up stage to ensure that the pieces were within the design tolerance before moving to final welding.



Post assembly CNC Machining of TEX-332 external mounting feet to RA1.6 – and grease grove.

TEX-332 supporting feet machined attached to duct wall to ensure flatness and co-planarity is achieved and uninhibited by the heat effects of welding.

NDT Certificates including PT and RT



INDEPENDENT TESTING & INSPECTION SERVICES (VIC) PTY. LTD
313A DOHERTYS ROAD, TRUGANINA VIC, 3029 Phone: 03 9366 6120
U7/100 MONASH DRIVE, DANDENONG SOUTH, VIC, 3175 Phone: 03 8768 8185
Email: info@itest.net.au
ABN: 17155520857

INSPECTION REPORT
RADIOGRAPHY - WELDS

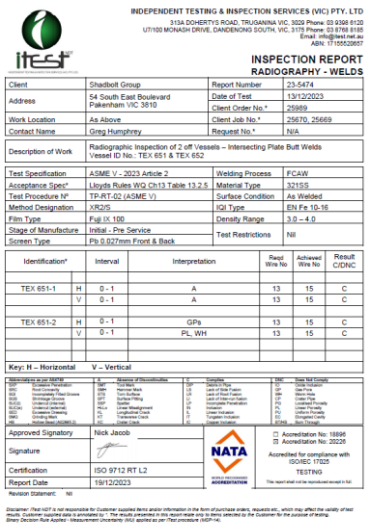
Client	Shadbolt Group Pty Ltd	Report Number	22-4435/2
Address	54 South East Boulevard Pakenham VIC 3810	Date of Test	1/08/2022
		Client Order No.*	21600
Work Location	As Above	Client Job No.*	24674
Contact Name	Rod Tozer	Request No.*	Not Advised
Description of Work	Radiographic Inspection of Vessel T-Points **Uptake Duct: TEX 332** Welder ID: 74 WPS: SG-DF-302		
Test Specification	ASME V - 2021 Article 2	Welding Process	FCAW
Acceptance Spec*	Lloyds Register Rules Chapter 13 Table 13.2.5	Material Type	321 Stainless Steel
Test Procedure N°	TP-RT-02 (ASME V)	Surface Condition	As Welded
Method Designation	GR1/EA-A	IQI Type	EN Fe 10-16
Film Type	Fuji IX 100	Density Range	2.5 – 4.0
Stage of Manufacture	Initial - Pre Service	Technician	Matt Kuczko & Shannan Taylor
Screen Type	Pb 0.027mm Front & Back	Test Restrictions	Nil

Identification*	Interval	Interpretation	Reqd Wire No	Achieved Wire No	Result C/DNC
ID: T1, Weld: Circ	0 – 1	A	W12	W13	C
ID: T1, Weld: Long	0 – 1	A	W12	W13	C
ID: T2, Weld: Circ	0 – 1	GP	W12	W13	C
ID: T2, Weld: Long	0 – 1	A	W12	W13	C
ID: T3, Weld: Circ	0 – 1	GP	W12	W13	C
ID: T3, Weld: Long	0 – 1	GP	W12	W13	C
ID: T4, Weld: Circ	0 – 1	A	W12	W13	C
ID: T4, Weld: Long	0 – 1	A	W12	W13	C

Approved Signatory Name	Jack Treffry	
Signature		NATA — Accreditation No: 18896, Accreditation No: 20226. Accredited for compliance with ISO/IEC 17025. TESTING
Certification	ISO 9712 RT L2	
Report Date	3/08/2022	

Revision Statement: Nil

[Form0] TF-RT-02 RT Welds Report Form Rev.16 10-8-21 TD



INDEPENDENT TESTING & INSPECTION SERVICES (VIC) PTY. LTD
313A DOHERTYS ROAD, TRUGANINA VIC, 3029 Phone: 03 9366 6120
U7/100 MONASH DRIVE, DANDENONG SOUTH, VIC, 3175 Phone: 03 8768 8185
Email: info@itest.net.au
ABN: 17155520857

INSPECTION REPORT
RADIOGRAPHY - WELDS

Client	Shadbolt Group	Report Number	23-5474
Address	54 South East Boulevard Pakenham VIC 3810	Date of Test	13/12/2023
		Client Order No.*	25989
Work Location	As Above	Client Job No.*	25670, 25669
Contact Name	Greg Humphrey	Request No.*	N/A
Description of Work	Radiographic Inspection of 2 off Vessels – Intersecting Plate Butt Welds Vessel ID No.: TEX 651 & TEX 652		
Test Specification	ASME V - 2023 Article 2	Welding Process	FCAW
Acceptance Spec*	Lloyds Rules WQ Ch13 Table 13.2.5	Material Type	321SS
Test Procedure N°	TP-RT-02 (ASME V)	Surface Condition	As Welded
Method Designation	XR2/S	IQI Type	EN Fe 10-16
Film Type	Fuji IX 100	Density Range	3.0 – 4.0
Stage of Manufacture	Initial - Pre Service	Test Restrictions	Nil
Screen Type	Pb 0.027mm Front & Back		

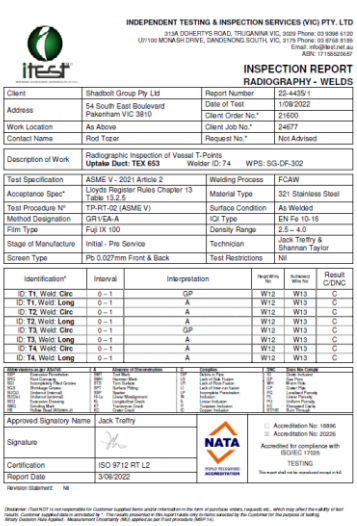
Identification*		Interval	Interpretation	Reqd Wire No	Achieved Wire No	Result C/DNC
TEX 651-1	H	0 - 1	A	13	15	C
	V	0 - 1	A	13	15	C
TEX 651-2	H	0 - 1	GPs	13	15	C
	V	0 - 1	PL, WH	13	15	C

Key: H – Horizontal V – Vertical

Approved Signatory	Nick Jacob	
Signature		NATA — Accreditation No: 18896, Accreditation No: 20226. Accredited for compliance with ISO/IEC 17025. TESTING
Certification	ISO 9712 RT L2	
Report Date	19/12/2023	

Revision Statement: Nil

[Form0] TF-RT-02 RT Report Form Rev.17 25-8-23 TD



INDEPENDENT TESTING & INSPECTION SERVICES (VIC) PTY. LTD
313A DOHERTYS ROAD, TRUGANINA VIC, 3029 Phone: 03 9366 6120
U7/100 MONASH DRIVE, DANDENONG SOUTH, VIC, 3175 Phone: 03 8768 8185
Email: info@itest.net.au
ABN: 17155520857

INSPECTION REPORT
RADIOGRAPHY - WELDS

Client	Shadbolt Group Pty Ltd	Report Number	22-4435/1
Address	54 South East Boulevard Pakenham VIC 3810	Date of Test	1/08/2022
		Client Order No.*	21600
Work Location	As Above	Client Job No.*	24677
Contact Name	Rod Tozer	Request No.*	Not Advised
Description of Work	Radiographic Inspection of Vessel T-Points **Uptake Duct: TEX 653** Welder ID: 74 WPS: SG-DF-302		
Test Specification	ASME V - 2021 Article 2	Welding Process	FCAW
Acceptance Spec*	Lloyds Register Rules Chapter 13 Table 13.2.5	Material Type	321 Stainless Steel
Test Procedure N°	TP-RT-02 (ASME V)	Surface Condition	As Welded
Method Designation	GR1/EA-A	IQI Type	EN Fe 10-16
Film Type	Fuji IX 100	Density Range	2.5 – 4.0
Stage of Manufacture	Initial - Pre Service	Technician	Jack Treffry & Shannan Taylor
Screen Type	Pb 0.027mm Front & Back	Test Restrictions	Nil

Identification*	Interval	Interpretation	Reqd Wire No	Achieved Wire No	Result C/DNC
ID: T1, Weld: Circ	0 – 1	GP	W12	W13	C
ID: T1, Weld: Long	0 – 1	A	W12	W13	C
ID: T2, Weld: Circ	0 – 1	A	W12	W13	C
ID: T2, Weld: Long	0 – 1	A	W12	W13	C
ID: T3, Weld: Circ	0 – 1	GP	W12	W13	C
ID: T3, Weld: Long	0 – 1	A	W12	W13	C
ID: T4, Weld: Circ	0 – 1	A	W12	W13	C
ID: T4, Weld: Long	0 – 1	A	W12	W13	C

Approved Signatory Name	Jack Treffry	
Signature		NATA — Accreditation No: 18896, Accreditation No: 20226. Accredited for compliance with ISO/IEC 17025. TESTING
Certification	ISO 9712 RT L2	
Report Date	3/08/2022	

Revision Statement: Nil

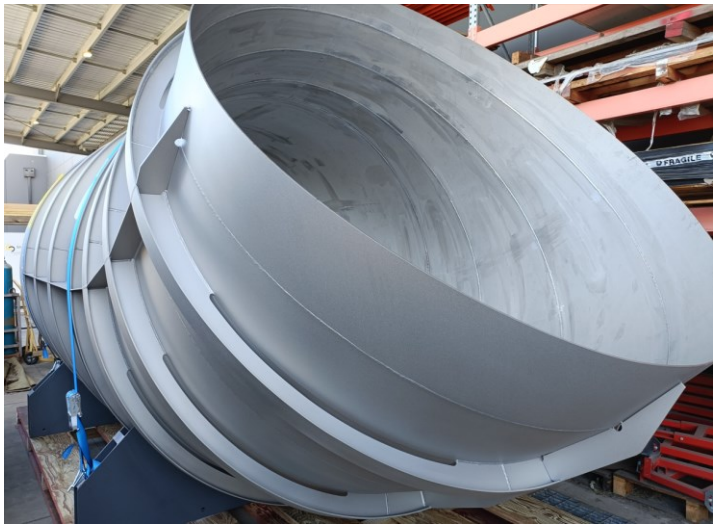
[Form0] TF-RT-02 RT Welds Report Form Rev.16 10-8-21 TD

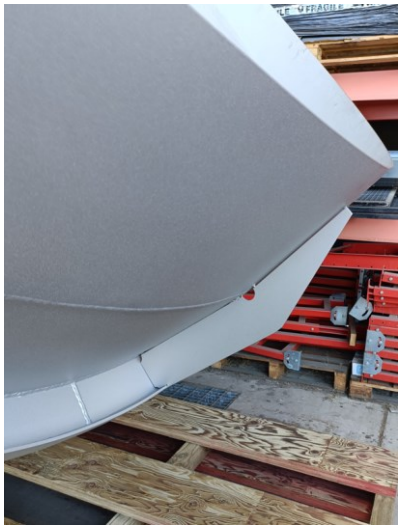
Fabrication completed. Out for Glass Bead Blasting.

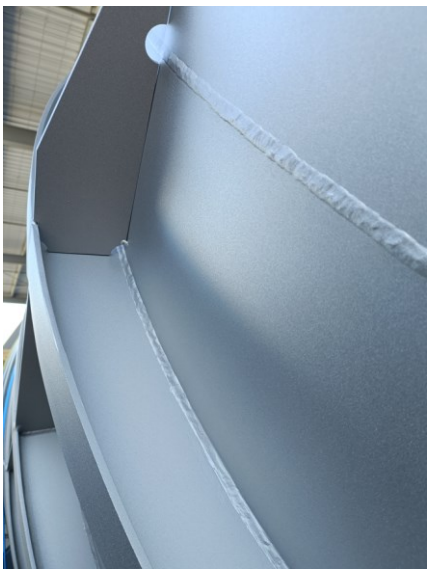




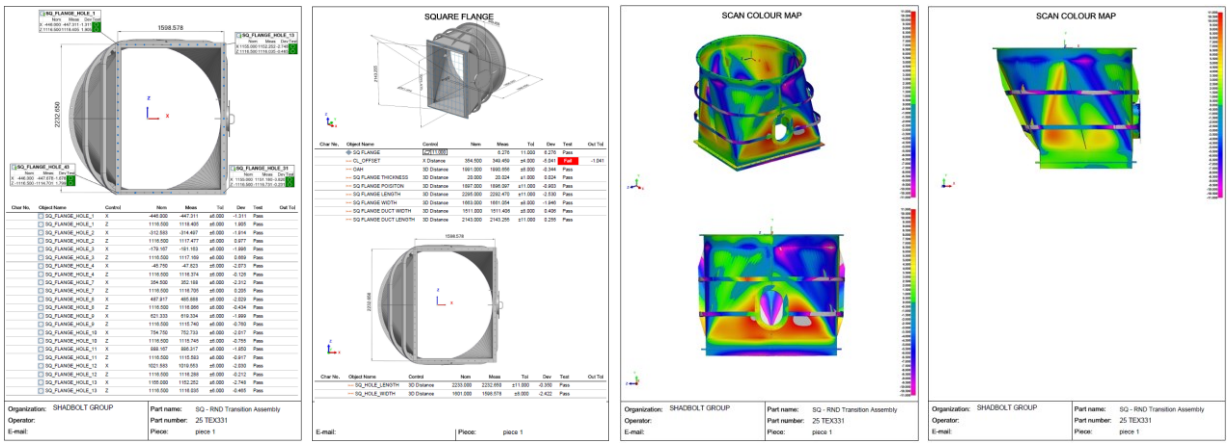

Final Surface Finish achieved.



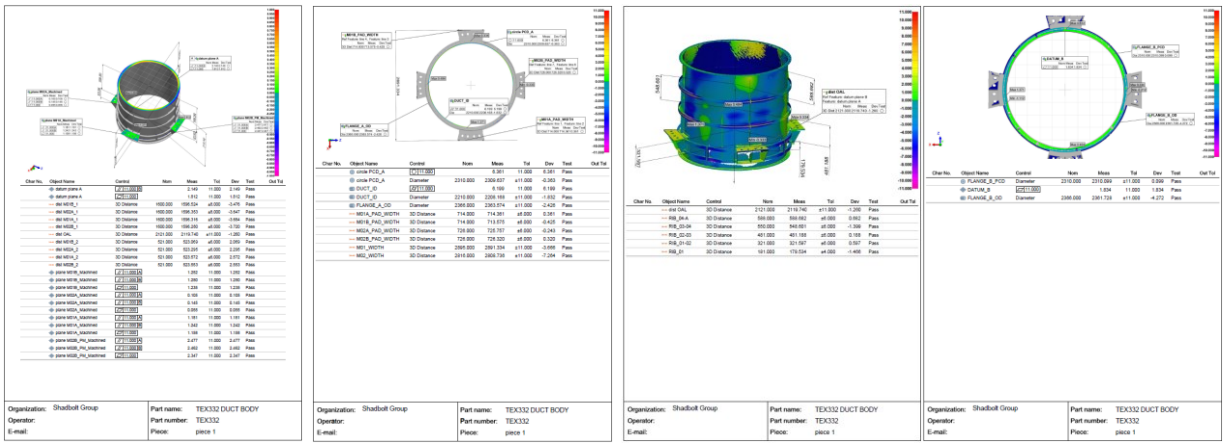




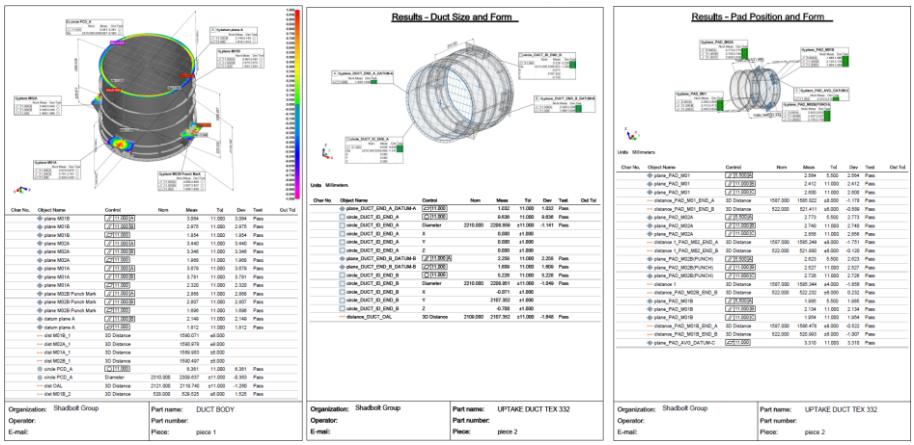
UPTAKE DUCT TEX 331 – Dimensional Results.



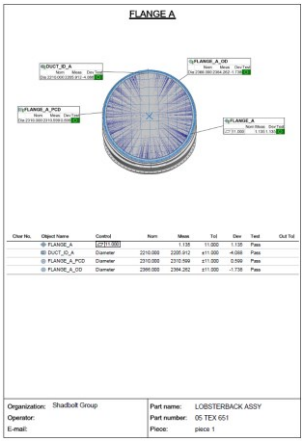
UPTAKE DUCT TEX 332 – Dimensional Results. Machined

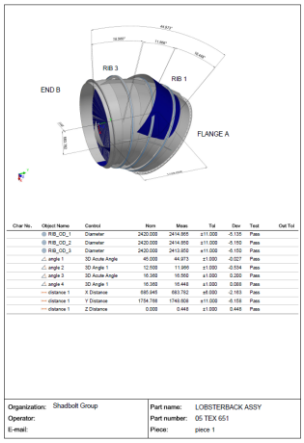


UPTAKE DUCT TEX 332 – Dimensional Results. Prior to Machining.

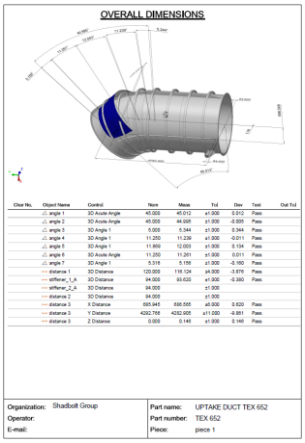


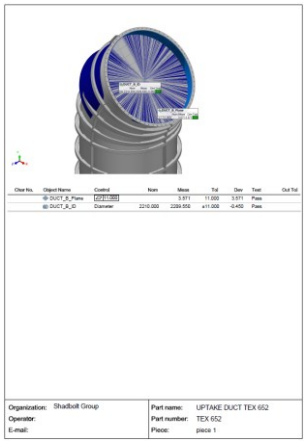
UPTAKE DUCT TEX 651 – Dimensional Results.

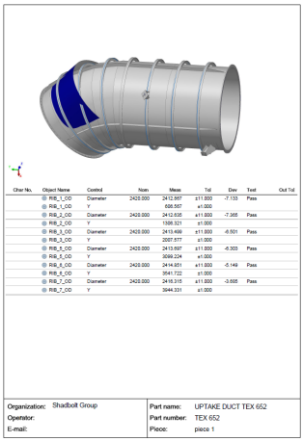




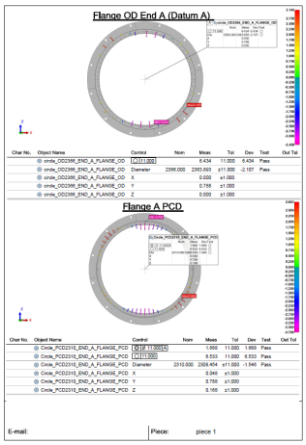
UPTAKE DUCT TEX 651 – Dimensional Results.

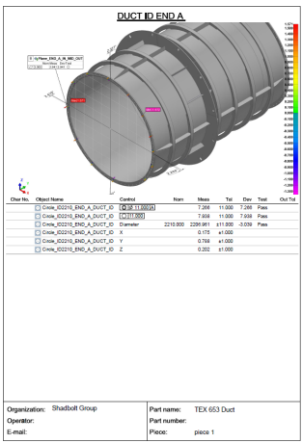


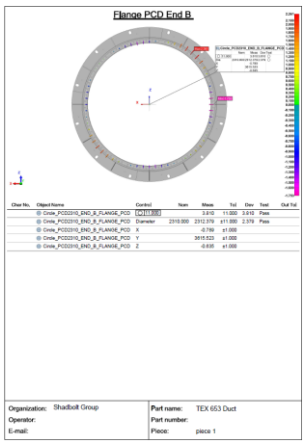


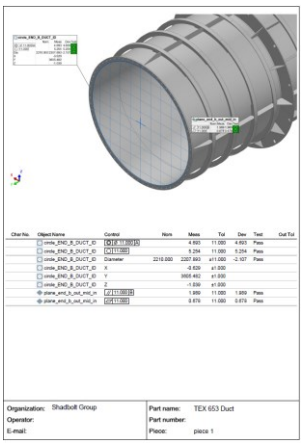


UPTAKE DUCT TEX 653 – Dimensional Results.









Pack Wrap and Strap. Ready to be delivered