1.0 SCOPE

This specification together with the drawings defines the requirements that the supplier shall comply with during the manufacture of components for CTL Seal Ltd (CTLS). Any deviation from this shall only be allowed with the written permission of CTLS.

ANY FEATURES PRODUCED THAT ARE NOT TO DRAWING MUST BE HIGHLIGHTED ON THE INSPECTION REPORT AND A CONCESSION REQUEST SUBMITTED TO CTL SEAL PRIOR TO ANY ITEMS BEING DELIVERED.

2.0 MATERIAL

Unless specified otherwise, material test certificates shall be in accordance with BS EN 10204 3.1. Material test certificates must be made available for approval by CTLS at any stage during manufacture.

All material permanently incorporated into fabrications shall be from new plate or sections.

Temporary bracing, erection aids, etc. need not be from new material but shall be of the same type and grade as the parent material. The use of non-stainless steel on stainless steel fabrication is prohibited, unless specifically specified on the drawing.

To ensure that the correct grade of material is used for each piece part, the supplier shall operate a material traceability system. It is a requirement to maintain the traceability of each piece part to its parent plate or section.

Stainless steel shall be protected against contamination from non-stainless steel during all stages of fabrication. Failure to comply will cause fabrications to be rejected.

3.0 FABRICATION

Structural plate shall be cut to size by shearing, thermal cutting, water jet or machining. Plates cold sheared shall have all sheared edges dressed by grinding to remove any micro-tears prior to fit up and welding. Thermal cut edges shall be ground to bright metal prior to fit up and welding. Weld preparations shall be in accordance with the drawings and the approved weld procedure.

3.1 WELDING

All welding shall be carried out in accordance with the recommendations stated in BS EN 1011 and in accordance with the drawings.

Butt welds specified as full penetration must have a depth at least equal to the plate thickness.

Butt welds specified as partial penetration must have penetration depths not less than that specified by the weld symbol. To achieve this, the prep should be cut +2mm to depth of weld required.

Butt welds additional to those shown on the drawings are only permitted with the written permission of CTLS.

Fillet welds shall have a minimum size (leg length or throat) of at least that specified by the weld symbol.

Permanent backing strips shall only be used with the prior agreement of CTLS.

All production welding shall be carried out using calibrated welding equipment.

3.2 FABRICATION AIDS

Temporary attachments that are not shown on the drawing, or described in this specification, shall be carried out to an approved welding procedure and in accordance with this specification.

When removing fabrication aids all welds shall be removed by grinding followed by Magnetic Particle Inspection to ensure the area is free from defects.

Only stainless steel of the same grade and type may be welded to stainless steel. When removing fabrication aids all welds shall be removed by grinding followed by Dye Penetrant Inspection to ensure the area is free from defects.

3.3 CONSUMABLES

All consumables shall be classified in accordance with recognized standards and supplied with a Test Certificate in accordance with BS EN 10204 3.1. Test certificates must be made available for approval by CTLS at any stage during manufacture.

The supplier shall be responsible for maintaining proper control and identification of welding consumables, and shall ensure that all electrodes and welding consumables are stored and handled in accordance with the manufacturer's recommendations. All unidentified, damaged, wet or rusty consumables shall be discarded / destroyed immediately.

3.4 PREPARATION AND FIT-UP

Weld preparations, including those necessary for repair work, may be prepared by machining, arc-air gouging, oxy fuel cutting and grinding.

All surfaces and edges to be welded shall be smooth, uniform and free from tears, cracks, gouges and other discontinuities that might otherwise affect the integrity of the weld.

Root gaps shall be in accordance with the root gap specified on the approved welding procedure.

The joint or preparation, and the surrounding areas shall be clean and free of moisture, oil, grease, scale, oxides or any protective coating or paint (including marker pen paint) for an area of at least 25mm either side of the joint preparation prior to the commencement of welding.

Misalignment between the centre line of members to be fillet welded in cruciform connections shall not exceed 10% of the plate thickness with a maximum of 5mm.

Misalignment of plate edges for butt welds shall not exceed 10% of the plate thickness with a maximum of 3mm.

Simple fillet connections shall have a maximum gap of 2mm. Larger gaps may be accepted as minor deviations, provided that the size of the fillet leg length is increased by 1.5 x the maximum gap.

All tack welding shall be done in accordance with the approved welding procedure as that used for the production weld.

All tack welds shall be a minimum length of 2 x plate thickness or 50mm whichever is the lesser.

Full penetration welds shall either have the tack welds removed prior to welding, or have the ends of tack welds feathered. Approved welders only shall do root tack welding.

3.5 PREHEAT AND INTERPASS TEMPERATURES

Minimum preheat temperature shall be established and maintained for a minimum of 75mm on either side of the weld centre line and the temperature measured on the opposite side to that being heated if possible.

Applications of preheat may be done using electrical resistance mats, oxy-fuel torches or radiant heaters. Deposition of carbon by incorrectly set burners or the use of burning torches for preheating is not permitted.

The maximum interpass temperature in production welding shall not exceed that recorded during welding procedure qualification.

3.6 PRODUCTION WELDING

All welding shall be carried out in accordance with a fully qualified welding procedure, which has been approved by CTLS. Any deviation from this shall only be permitted with the written consent of CTLS.

Existing welding procedure specifications shall as a minimum comply with BS EN ISO 15609-1.

The Supplier shall establish Weld Procedure Specifications (WPSs) or working instructions in accordance with the approved pre-qualified welding procedure qualification records and this specification.

Weld Procedure Specifications or work instructions shall as a minimum contain details of the following: -

1. Type and grade of steel to be welded
2. Thickness range qualified
3. Edge preparation and fit-up, including sketch
4. Welding process or processes and equipment
5. Type and size of electrodes or wire/flux combination
6. Position and direction of welding
7. Stringer or weave technique
8. Current, voltage, polarity and welding speed
9. Minimum preheat and maximum interpass temperatures, application methods and controls.
10. Back-gouging method and control if applicable
11. Welding Procedure Qualification Record Number.

All welders shall be qualified in accordance with BS EN ISO 9606

For double-sided welds, clean sound metal shall be ensured on which to deposit subsequent runs. If arc-air gouging is used, minimum preheat requirements will apply and all debris and carbon shall be removed by grinding for a minimum of 3mm.

Arc strikes outside the weld preparation shall be avoided and the arc should only be struck on those parts of the weld or parent metal where welding is yet to take place. Arc strikes outside the preheated area of the weld shall be removed by grinding and MPI carried out on that area.

Each weld run shall be thoroughly cleaned of spatter and welding flux/slag before subsequent runs are deposited. This shall be by chipping, wire brushing, grinding, etc. Peening shall not be permitted.

Where practicable, weld starts and stops shall be staggered so that adjacent weld runs do not contain starts of stops within 50mm of each other.

The maximum width of weave shall not exceed that used for the welding procedure qualification.

The supplier shall be responsible for the development of welding sequences to minimise residual stress, distortion and warping.

3.7 Post Weld Heat Treatment

Where designated, post weld heat treatment shall be carried out in accordance with the specific instructions shown on the drawing.

4.0 Inspection and Non-Destructive Testing (NDT)

All inspection and NDT shall meet the requirements of this specification, and shall be carried out with the equipment most suitable to detect typical associated defects, considering joint design, welding process, position, etc.

All NDT operators shall be approved in accordance with section 4.2.
Ultrasonic testing (UT) shall be carried out no earlier than 48 hours after completion of welding.

Magnetic Particle Inspection (MPI) shall be carried out no earlier than 48 hours after welding unless otherwise agreed with the Welding Engineer.
Dye Penetrant (DP) shall be carried out no earlier than 24 hours after completion of welding. On stainless steel DP can be carried out at ambient temperature.

When welds are required to be post-weld heat-treated the NDT shall be conducted pre and post-weld heat treatment.

The Inspection status of all items being manufactured under the contract shall be recorded throughout manufacture.

All fabrication dimensions shall be checked prior to welding. Any deviation from the tolerance stated on the drawing must be reported to CTLS and the work placed on hold.

Unless specified otherwise on the drawing, the extent of NDT shall be - :

Butt Welds	100% visual 10% MPI / DP 10% UT (Full penetration weld in 8mm plate or thicker
Fillet Welds	100% visual 10% MPI / DP

4.1 Post Weld Inspection

All dimensional inspection shall be undertaken when all welding is complete. Any temporary bracing and fabrication aids shall be removed prior to inspection. Any deviation from the tolerance stated on the drawing shall be reported to CTLS and the work placed on hold.

Visual inspection shall be carried out on the welds and adjacent areas for any surface defects to welds or plate such as cracks, gouges, arc strikes etc.

4.2 Inspection Procedures and Qualifications

Company procedures shall be approved by a level 3 qualified person unless otherwise agreed by the Welding Engineer.
Visual inspection shall be undertaken in accordance with BS EN ISO 17637. The surface of the weld shall have an even finish and shall blend smoothly into the parent plate with no gross irregularity or undercut and shall be free from spatter or slag. All visual welding inspectors shall be qualified to CSWIP or an alternative standard approved by CTLS.

Ultrasonic Testing (UT) shall be undertaken in accordance with BS EN ISO 17640 using a minimum frequency of 4 MHz, UT operators shall be qualified to PCN Level 2.

Magnetic Particle Inspection (MPI) shall be undertaken in accordance with BS EN ISO 17638. Light surface grinding of welds may be carried out to ensure a smooth surface for MPI. MPI operators shall be qualified to PCN Level 2.

Dye Penetrant Inspection (DP) shall be undertaken in accordance with BS EN ISO 3452-1. Light surface grinding of welds may be carried out to ensure a smooth surface for DP. DP operators shall be qualified to PCN Level 2.
All inspection and NDT shall be properly documented and identified and made available for approval by CTLS at any stage during manufacture.

Inspection and NDT records shall be traceable to each piece part or assembly as appropriate.

5.0 Defect Acceptance Levels

In accordance with the levels laid down in APPENDIX A & B.

6.0 Weld Repairs

The supplier shall inform CTLS of any defects found by visual or NDT techniques. If cracking is reported, work shall stop until an investigation into the cause and a repair method has been agreed with CTLS.
Defects shall be removed by machining, grinding or arc air gouging followed by grinding. For single-sided weld root repairs, the last 2mm shall be removed by grinding. If repair excavations are less than 10mm apart they shall be linked into a single repair.

The repaired area shall be inspected and examined in accordance with the original requirements.

7.0 Identification / Hard Stamping

Where notified, all items shall be permanently identified/hard stamped in accordance with the drawing using low stress stamps. The identification/stamping shall be of sufficient depth to be visible after any surface treatment and painting
If requested on the purchase order, items shall also be identified/stamped with an agreed traceability system i.e. serial/batch number and unique supplier identification.

8.0 Assembly

All fastenings shall be torqued in accordance with the drawing.

Loctite shall only be used if specified on the drawing.

All pins and bores shall be greased, unless specified on the drawing.

Hydraulic assembly shall be carried out in a clean and acceptable environment. All fittings must be protected as a minimum with a plastic plug/cap to prevent the ingress of contamination.

9.0 Painting

Paint storage and painting shall be carried out in accordance with the paint manufacturers' recommendations and any separate painting drawings supplied by CTLS.

10.0 Inspection Reports

When completing an inspection report ensure that ALL the features on the drawing that you have produced are recorded on the report unless otherwise stated by the purchaser.

The sub-contractor may use their own reporting format, but the report shall include ALL of the fields as shown in the preferred report form (Appendix A). Please contact the purchaser if you want an electronic copy of appendix D.

All documentation as requestion on the purchase order must be with the delivered (or collected) items.

Any features produced that are non-conforming to the drawing or purchase order must be highlighted on the inspection report and a concession request submitted to CTL Seal prior to any items being delivered.

If the subcontractor is unsure on any inspection requirements for the products, they are producing, please contact the purchaser.

11.0 Calibrated Equipment

The subcontractor must use calibrated measuring equipment for all inspection unless previously agreed by the purchaser.

When required, the subcontractor must record the calibrated measuring equipment they have used to carry out the inspection.

The sub-contractor may use their own reporting format, but the report shall include ALL of the fields as shown in the preferred report form (Appendix B). Please contact the purchaser if you want an electronic copy of appendix B.

If the subcontractor does not have the required equipment, please contact the purchaser.

12.0 Inspection & Test Plan

If requested on the purchase order, the supplier shall submit an Inspection & Test Plan (ITP) to CTLS for approval prior to the commencement of any work. This plan will identify how the supplier will meet the requirements of this specification.

An acceptable ITP format is shown in APPENDIX C.

13.0 Deviation Authorization

Any deviation from this specification must have written authorization from CTLS prior to delivery.

APPENDIX A

DEFECT ACCEPTANCE CRITERIA FOR BUTT JOINTS

Quality Category	Ultrasonics	MPI / DP	Visual
Cracks	Not permitted	Not permitted	Not permitted
Lack of fusion / Lack of root penetration	t ≤20mm: l≤10mm *. h≤2mm t >20mm: l≤15mm *. h≤2mm	t ≤20mm: l ≤10mm *. h≤2mm t > 20mm: l ≤15mm *. h≤2mm	t≤20mm: l≤10mm *. h≤2mm. t>20mm: l≤15mm *. h≤2mm. Only applicable for single sided welds
Individual slag inclusions	t ≤20mm: l≤12mm*. w≤1.5mm t >20mm: l≤20mm *. w≤1.5mm	Not applicable	Not applicable
Linear group of inclusions	Any length of group provided adjacent groups are separated by a distance of at least 4 times the length of the longest defect for t ≤ 20mm and by a distance of at least 6 times the length of longest defect for t > 20mm.	Not applicable	Not applicable
Porosity	Individual pores : ≤ 2.5mm dia. Localised: ≤ 3% by area $.	Surface porosity individual pores: ≤ 2mm dia. Localised: ≤ 3% by area $	Surface porosity individual pores: ≤ 2mm dia. Localised: ≤ 3% by area $.
Undercut #	Intermittent, 0.5mm max in depth	Intermittent, 0.5mm max in depth	Intermittent, 0.5mm max in depth

t is parent metal thickness
l is length of any individual defect
h is height of defect
w is width of defect
$ The area to be considered should be the length of weld affected by porosity times the max width of the weld
* Intermittent defects shall be separated by a distance greater than the longest individual defect or they shall be classed as one continuous defect.
# The acceptability of undercut should be at the discretion of the supplier's quality control department in consultation with CTLS and any inspection authority.

APPENDIX B

DEFECT ACCEPTANCE CRITERIA FOR FILLET WELDS

Quality Category	Ultrasonics	MPI / DP	Visual
Cracks	Not permitted	Not permitted	Not permitted
Porosity	Individual pores : □ 2.5mm dia. Localised: □ 3% by area $.	Surface porosity individual pores: □ 1.5mm dia. Localised:□□ 4% by area $.	Surface porosity individual pores: □ 1.5mm dia. Localised:□□ 4% by area $.
Undercut #	Intermittent, 0.5mm max in depth	Intermittent, 0.5mm max in depth	Intermittent, 0.5mm max in depth
Throat Thickness	Total throat thickness or leg length to be not less than that specified	Not applicable	Total throat thickness or leg length to be not less than that specified
Fit-Up	Not applicable	Not applicable	For partial penetration t-joints the results of joint preparation and fit-up to be recorded.

t is parent metal thickness
l is length of any individual defect
h is height of defect
w is width of defect
$ The area to be considered should be the length of weld affected by porosity times the max width of the weld
* Intermittent defects shall be separated by a distance greater than the longest individual defect or they shall be classed as one continuous defect.
# The acceptability of undercut should be at the discretion of the supplier's quality control department in consultation with CTLS and any inspection authority.

APPENDIX C

Inspection and Test Plan :-	**SUPPLIER NAME:**	CTL Seal			
CUSTOMER:	**WORKS ORDER NUMBER:**		**DATE:**	**ITP REF No:**	**ITP Revision:**
?????	8424		**-**-****	****-01	0
WORK DESCRIPTION:	**CUSTOMER PURCHASE ORDER NO:**		**CREATED BY:**	**APPROVED BY:**	
Arm Skid LH, Front Skid RH & LH, Fabrication Stabiliser Arm	?????		R W Furness	????	

OP NO	ACTIVITY	BY DEPT	PROCEDURE REFERENCE	ACCEPTANCE CRITERIA	INSPECTION POINTS				VERIFYING DOCUMENTATION
					CTLS	????			
1.0	**CONTRACT REVIEW**								
1.1	Review of Technical Specification	Project Manager	Flowchart 01, WI07	CTL Seal ability to complete the order	H				Contract / Technical review
1.2	Review of Drawings	Project Manager / Production	Flowchart 01, WI07	CTL Seal ability to complete the order	H				Contract / Technical review
2.0	**DOCUMENTATION / APPROVALS**								
2.1	Produce Production schedule	Project Manager	Process 04	Customer approval (if required)	H				
2.2	Produce Inspection and Test Plan	Quality	Process 04	Customer approval	H				1 - ITP
2.3	Review Suppliers / Subcontractors	Quality	Process 06	Process 06 / Customer approval (if required)	H				
2.4	Review Weld Procedures	Quality	WI 12.	Customer approval	H				2 - Welding Procedures & WPQRS
2.5	Review Welder Qualifications	Quality	WI 12	Customer approval	H				3 - Welder Qualifications
2.6	Review NDE Operator qualifications	Quality	PCN level 2	Current certificate	H				12- NDT Operators Certificates
2.7	Review NDE - MPI Procedure	Quality	MPI 01 ISS 7	Customer approval	H				4 - NDT Procedures
2.8	Review NDE - Ultrasonic Procedure	Quality	GEN/UT/MEPA Iss 8	Customer approval	H				4 - NDT Procedures
2.9	Review NDE - Dye Penetrant Procedure	Quality	???	Customer approval	H				
2.10	Review NDE - Radiographic Procedure	Quality	???	Customer approval	H				
2.11	Issue Procedure	Quality	WI 04	Customer approval (if required)	R				
2.12	Welding Equipment Calibration Records	Quality	WI 13	Current Calibration certificate	R				
2.13	Dimension Control & Recording Proc.	Quality	WI 25	Customer approval (if required)	R				
2.14	Weighing Procedure	Quality	WI 20	Customer approval (if required)	R				
2.15	Material test certification	Quality	WI 61	BS EN 10204 type certificates	R				
3.0	**NON- CONFORMING PRODUCTS**								
3.1	Identification of non-conformance	Quality	QP 03	Customer Concession	H				5 - Non-Conformance Reports & Client Concessions
4.0	**PURCHASING**								
4.1	Purchase of product and services	Project Manager	Process 07	Purchase Order	M				Purchase Orders
4.2	All Steel Plate	Production	Purchase Order	Grit blasting to BS 7079 SA2.5	M				
4.3	Plate 50mm thick or above	Quality	Purchase Order	UT inspection to BS EN 10160 S1/E3	M				11 - UT Report
5.0	**RAW MATERIAL CONTROL**								Delivery Note
5.1	Receipt	Stores	WI 01	Purchase Order	H				Test Certificates vs Purchase Order
5.2	Identification	Stores	Process 07	Purchase Order	H				6 - BS EN:10204:3.1 Matl Test certs

1

Appendix D

Inspection Record Sheet

Description	**Drawing No. / Rev**	**PO No.**		**CTLS WO No.**	**Inspector**
Customer	**Part No.**	**Serial No.**	**Qty**	**Process**	**Date**

Ref / Zone	**Specification / Tolerance (mm)**	**Result**	**Conclusion**		**Comments**
			OK	**NOK**	

Appendix E

W/O No:			Drawing No:		
Equipment type	Equipment model	Unique ID No	Inspection name	Inspection Signature	Inspection date

Change History				
Rev No.	**Date**	**Author**	**Reason**	**Reviewed/Approved**
02	18/10/2022	R Wright	Point 1. Paragraph 2 added. "Sub-Contract" added to title.	R W Furness
03				