SENSORS DIVISION

UK

VISUAL ACCEPTANCE CRITERIA

QP32-05 Issue 03

APPROVERS

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CONTENTS

1 CHANGE RECORD

Issue No.	Section(s) affected	Reason & Details of Change	Change originated by:	Date (DD/MM/YYYY)
1	All	CW Visual Acceptance Criteria defined by group. New procedure for UK, superseding criteria contained in QP32-03 issue 2	Malc T	19/03/2020
		Changed the division name in the title table to align with the organisational changes. 2.1 Doc. ref. corrected to **X**55-301 6.5 & 6.7 modified sentences for correct meaning **Note:** *The amends listed in this box do not require this procedure to be up issued*	Eva J	23/11/2022
2	Appendix	Added acceptance criteria of the Track Surface marks	Eva J	June 2023
3	Scope 6.6, 6.7, 7.1, 7.3 7.3 9 Appendix	Modified to clarify requirements for Supplier with respect to FOD control. Rephrased for clarity of the inspection requirement. Added requirement for seat inspection to align within the USA QP-20020E amends and UK inspection method. Added Conductive track acceptance criteria. Added description to Conductive Track images of 'Unacceptable' damages.	Eva J	05/12/2023

All changes to this document will result in a complete update and full authorisation and approval by the relevant personnel. It is the responsibility of QA to ensure that the revised procedure is promptly updated with any superseded copies being removed.

2 RELATED DOCUMENTS

2.1 INTERNAL DOCUMENTS

Description	Doc. No.
Control and Disposition of Non-Conforming Product	QP31-01
Customer Eyes – Final QC Inspection	QP32-03
Manufactured Parts Specification	X55-301

2.2 EXTERNAL DOCUMENTS / SYSTEMS

Description	Doc. No.
AS9100	Rev. D

3 SCOPE

The purpose of this procedure is to provide visual acceptance criteria for Curtiss Wright 'Sensors' machined, assembled, and procured products, and applies to all internal manufacturing and inspection activities.

This document does not supersede any engineering drawing requirements.

To control FOD, the Supplier should follow the guidelines as detailed in the X55-301 Manufactured Parts Specification procedure, Sections 3 & 4.

4 RESPONSIBILITY

4.1 Curtiss Wright Engineering and Quality Management are responsible for the application and administration of this procedure.

4.2 All Curtiss Wright employees are responsible for properly handling and documenting non-conforming material in accordance with procedures.

4.3 Suppliers are responsible for providing products that comply with the visual standards of this procedure, unless otherwise stated on the associated engineering drawing or purchase order.

5 DEFINITIONS OF TERMS

Term	Definition
Surface Defect or Imperfections	A surface defect that can be felt
Contamination	The presence of unwanted material or residue on or inside of a part or product
FOD (Foreign Object Debris/Damage)	Foreign material or damage introduced into/onto the part during the machining, assembly, inspection, or packaging processes.
Surface Roughness	The finely spaced surface irregularities caused by machining feed-rate, tool geometry, and tool condition
Surface Waviness	Surface irregularities that have a spacing greater than the surface roughness. Usually due to warping or vibrations during machining.
Surface Lay	The direction of the surface pattern produced by the machining method
Base Material	The parent material to which a coating or plating is applied
Flow Hole	A component feature intended to be a pneumatic or hydraulic passage
MRB	Material Review Board

6 GENERAL REQUIREMENTS

6.1 The surface flaws and defects defined in this document shall not be evaluated using a surface roughness measurement. They shall be evaluated per the requirements of this document. Surface roughness is a measurement of closely spaced irregularities caused by machining operations. Flaws and defects are unintentional, discrete, and infrequent.

6.2 Visual defect definitions and accept / reject criteria are included in the Component Inspection Matrix (Table 1) of this document.

6.3 When measuring the size of defects, it is permissible to validate the length, width, and depth by any practical means (scale, Vernier calliper, comparator, moulding, etc.).

6.4 Additional clarifications of requirements and examples of historical nonconformities are included in the Appendix to this document (some of the images and examples contained may not apply to current CWC products but represent a sample of required acceptance and rejection levels).

6.5 Defects found on sealing grooves, sealing surfaces, threads, and functional interfaces generally are not acceptable. See the Component Inspection Matrix (Table 1) for details. If a technician or inspector is unable to identify if the surface is a sealing groove, sealing surface, or functional interface, they are responsible for contacting the appropriate person for clarification.

- Curtiss Wright suppliers shall contact the CW buyer associated with the purchase order.
- Curtiss Wright employees shall contact a quality assurance representative.

6.6 Rejected parts must be processed in accordance with the Reject Control Procedure. Suspected non-conforming parts must be clearly identified as faulty and placed in a designated quarantine area for the further investigation by MRB for appropriate action.

6.7 If a Final QC / CEO Inspection is required (e.g., traveller, routing, or purchase order), inspect the part against the appropriate 'Final Inspection' documentation meeting the requirement defined in this procedure.

6.8 Visual features shall fall into the following categories:

- Acceptable without rework (in compliance with Table 1)
- Acceptable with immediate rework activity (described in Table 1)
- Rejected – product with visual defects deemed unacceptable shall be considered as non-conforming and dealt with in accordance with the Reject Control Procedures

7 VISUAL EXAMINATION PROCEDURES

7.1 Visual inspection must be performed on procured parts, all final assembly, and on assembly after gauges or tooling is utilised.

7.2 Part inspections shall take place under lighting conditions of 1100 lux minimum. The inspector's vision shall be corrected for 20/20 vision.

7.3 Magnification

Within the internal inspection process:

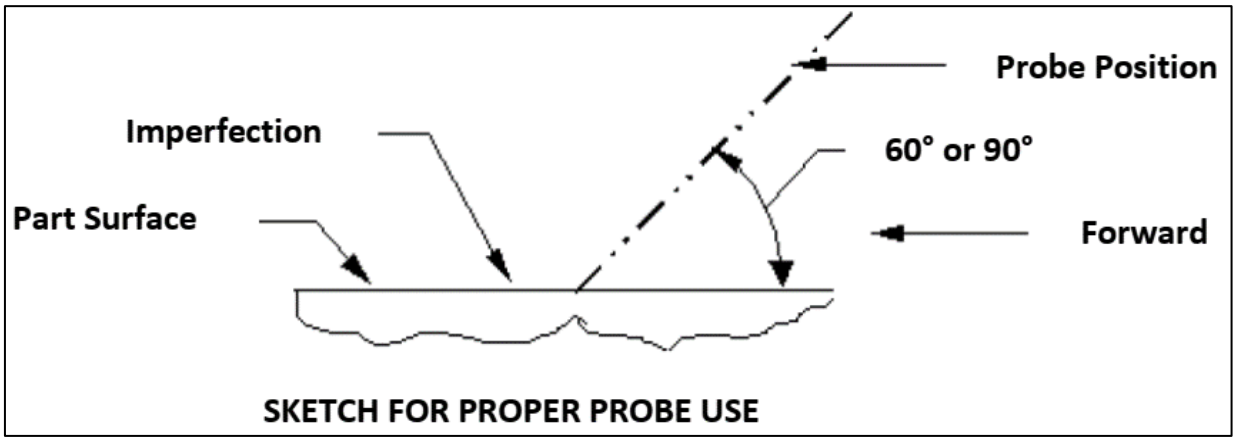
- All accessible surfaces shall be inspected with an unaided eye and at distance of half an arm's length. If abnormalities are found, then x10 magnification is to be utilised to verify the abnormity.
- All 'O' ring groove surfaces shall be inspected at x10 magnification for surface defects, burrs, contamination, chips, and FOD.
- All internal and external threads shall be 100% inspected at 10x for burrs, contamination, chips, and FOD.
- All internal passages and blind holes shall be 100% visually inspected with x10 magnification for burrs, contamination, chips, and FOD. Areas that are difficult to access may require mirrors, borescopes, or fibre etc.
- Holes shall be examined from both sides, when possible.
- Blind holes shall be inspected with a borescope (when practical) for burrs, contamination, chips, and FOD.
- Parts where the drawing identifies a seat and/or seat edge shall be 100% visually inspected with x10 magnification for nicks, burrs, and scratches. Area that are difficult to access may require mirrors, borescopes.

8 SURFACE DEFECT & IMPERFECTION VALIDATION

8.1 For visually detected surface defects that may be tactile, are to be validated using a 0 .025” radius spherical ruby probe.

8.2 Probe Inspection Method

- Hold the probe lightly near the top between the thumb and forefinger.
- Incline the probe at 60 degrees to the part surface toward the imperfection.
- Push the probe forward over the surface without applying pressure other than the weight of the probe itself in a direction approximately 90 degrees to the lay of the imperfection.
- If the movement is smooth with no interruption and the probe does not hesitate or catch in the imperfection, the imperfection is acceptable.
- If the probe cannot be positioned at 60 degrees to the part surface due to part configuration, the probe can be held at 90 degrees to the part surface.



SKETCH FOR PROPER PROBE USE

9 VISUAL INSPECTION CRITERIA

FEATURES	DEFINITIONS	APPLICABLE PARTS	ACCEPT / REJECT	CONDITION
Blister	A localized lifting of coating, plating or paint from base material, appearing as a protuberance that may break when probed.	All coated, plated, or painted parts and details.	REJECT	ALWAYS
			ACCEPT	NEVER
FOd (D)	Foreign Object, any object not part of the unit or component that has either become detached or external to the part or unit (Environmental, Potting, Metallic Chips etc).	All parts and details	REJECT	ALWAYS
Burr	A rough ridge, edge, or poorly attached material left at the intersection of two surfaces. Typically produced during machining operations.	On seal grooves, sealing surfaces, internal passages, threads, and flow holes	REJECT	ALWAYS
		All other surfaces and features	REJECT	If length is greater than 0.003" or it is hanging, loose, or can be easily dislodged.
Burnish Mark	A local smoothing of a metal surface. Often to a high lustre resulting from rubbing. It may contain scratches of no apparent depth. Includes buffing and polishing marks.	All parts and details on un-painted areas only	ACCEPT	Provided that it meets the probe inspection requirement, and the material thickness meets drawing requirement.
Chatter Mark	A tool mark on material caused by vibration or jumping of a machine cutting tool.	All parts and details	REJECT	Not acceptable in seal grooves or sealing surfaces
			ACCEPT	On all other surfaces provided part meets drawing surface roughness requirement.
Chip	A breaking away of an edge sometimes caused by impact from a foreign object. Material is removed.	All parts and details	REJECT	ALWAYS
Conductive Track	Anomalies to the conductive track used mainly on rotary tracks.	Conductive Track	REJECT	Damage to Track, i.e., deep scratches are not acceptable.
			REJECT	Damage to Tracks, i.e., Divot/Damage are not acceptable.
			REJECT	Damage to Tracks, i.e., raised surfaces are not acceptable.
			ACCEPT	Superficial marks with no apparent depth at the areas of correction during a linearity process.

FEATURES	DEFINITIONS	APPLICABLE PARTS	ACCEPT / REJECT	CONDITION
Corrosion	A deterioration of the metal resulting in change of colour and leaving a rough surface that may show pits (small cavities).	All parts and details	REJECT	ALWAYS
			ACCEPT	NEVER
Crack	A tear or fracture in the material surface	All parts and details	REJECT	ALWAYS
			ACCEPT	NEVER
Crazing	A network of fine cracks on the surface of a material	Typically occurring in polymers and coatings	REJECT	ALWAYS
			ACCEPT	NEVER
Dent	A depression in a surface, normally having rounded edges, corners, and bottom. Caused by an impact with a blunt object	On seal grooves, sealing surfaces, CP track paths, threads, and functional interfaces.	REJECT	ALWAYS
		On edges	ACCEPT	Provided no base material is exposed, meets the edge break tolerance requirement, and is less than 0.005" deep.
		On all other surfaces	ACCEPT	Provided it meets all dimensional tolerances, meets the probe inspection requirement, has rounded edges, and there is no base material is exposed.
Nick	A depression in a surface with raised material. Caused by an impact with a sharp edge or object.	On seal grooves, sealing surfaces, CP track paths, threads, and functional interfaces	REJECT	ALWAYS
		On edges	ACCEPT	Provided no base material is exposed, meets the edge break tolerance requirement, and is less than 0.005" deep.
		On all other surfaces	ACCEPT	Provided it meets all dimensional tolerances, meets the probe inspection requirement, has rounded edges, and there is no base material is exposed. Cannot be longer than 0.010”.
Gouge	A wide, rough scratch usually with sharp corners accompanied by deformation. The depth is generally larger than the width.	All parts and details	REJECT	ALWAYS

FEATURES	DEFINITIONS	APPLICABLE PARTS	ACCEPT / REJECT	CONDITION
Scratch	A long, narrow sharp cornered impression caused by the movement of a sharp object across a surface. The depth is assumed to be no greater than the width.	On seal grooves, sealing surfaces, CP track paths, threads, and functional interfaces	REJECT	ALWAYS
		Superficial scratches (a scratch that has no apparent depth)	ACCEPT	Provided it meets all dimensional tolerances, meets the probe inspection requirement, has rounded edges, and there is no base material is exposed.
		On all other surfaces	ACCEPT	Provided it meets all dimensional tolerances, meets the probe inspection requirement, has rounded edges, and there is no base material is exposed. Cannot be longer than 0.050".
Rack Mark	A small depression or cavity caused by racking during an anodize or hard coating process.	All parts and details	ACCEPT	Provided the rack marks are not on seal grooves, sealing surfaces, and functional interfaces.
		All parts – External Surfaces	REJECT	Marking on external, (customer facing) surfaces need to be highlighted to QA for review.
Discoloration	A localized or generalised change in colour of the part. May be induced by Induction, Welding, Heat Treatment, or Etching.	All heat-treated parts and details made of steel, nickel alloys	ACCEPT	Provided it is an even light straw or light blue in colour and free of corrosion.
		All nitride parts and details	ACCEPT	Provided it is light to dark grey in colour.
		All Anodised parts	ACCEPT	Provided it is uniform light grey.
		All Hard Anodised parts	ACCEPT	Provided it is adherent, uniform in colour and not powdery.
		Alocrom	ACCEPT	Provided it is a uniform gold/yellow colour. Some variation is allowable in touch up areas.
		Electro-less nickel-plated parts	ACCEPT	Any very light shading may be acceptable – refer part to the QA department.
		Electro-less nickel-plated parts	REJECT	Any major discoloration is not acceptable.

FEATURES	DEFINITIONS	APPLICABLE PARTS	ACCEPT / REJECT	CONDITION
Fettling	Removal of excess material or surface defects from casting flash/forging seams and other similar parts.	All parts and details	ACCEPT	Provided material removal areas are blended and uniformed. Drawing limits must be maintained.
		All parts and details	REJECT	If any surface treatment is compromised.
Fingerprint	Stains left by unprotected hands.	All parts and details	ACCEPT	Provided that the stain is completely removed.
Flaking/Peeling	A section or area of a plated, anodized, painted, or other coating medium that lifts away from the intended surface.	All parts and details	REJECT	ALWAYS
Stain or excess processing material	Local visual indication resulting from liquid drying on parts e.g., Alocrom. Includes ANY processing material which is visible on the component.	All parts and details	ACCEPT	Provided there is no visible change in height and excess has been cleaned. Must meet drawing requirement.
			REJECT	If excess material remains after cleaning.
Step	An abrupt change in a surface profile or a mismatch between two or more surfaces.	All machined parts and details	REJECT	Not acceptable in seal grooves or sealing surfaces.
			ACCEPT	Provided it complies with drawing requirements.
Surface Finish	The result of the machining process including roughness, waviness, and lay.	All machined parts and details	ACCEPT	MUST meet drawing requirements.
Tool Mark	A mark in the direction of the machining lay left by the machining tool or across the lay caused by tool withdraw or metal chips. Marks can be straight, circular, or spiral. Can also be caused by a dull or broken tool.	All machined parts and details	ACCEPT	Provided part meets drawing surface requirement and scratch requirements per this table.
Undercut	A groove or recess cut into a surface near a shoulder or other projection.	All machined parts and details	REJECT	Not acceptable in seal grooves or sealing surfaces.
			ACCEPT	Provided it blends smoothly with adjacent surfaces and that it is within drawing tolerances.

Appendix

Dent/Nick/Chip/Gouge/Scratch Visual Differences and Identification:

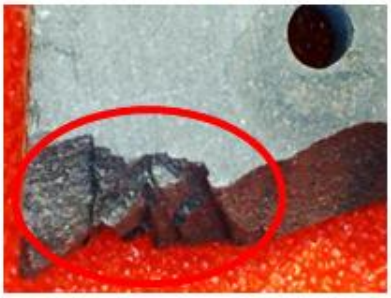
Dent

A depression with rounded edges caused by impact with a blunt object

Nick

A depression with raised material caused by impact with a sharp edge

Chip



A breaking away of an edge caused by impact from a foreign object

Gouge

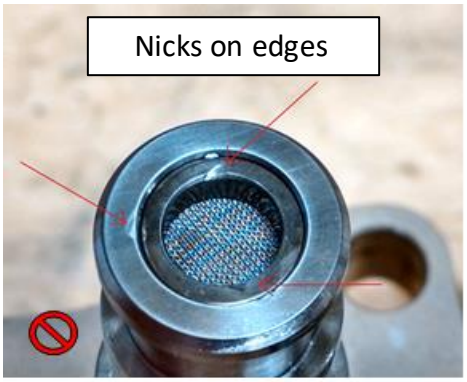
A wide, rough scratch with sharp corners and deformation

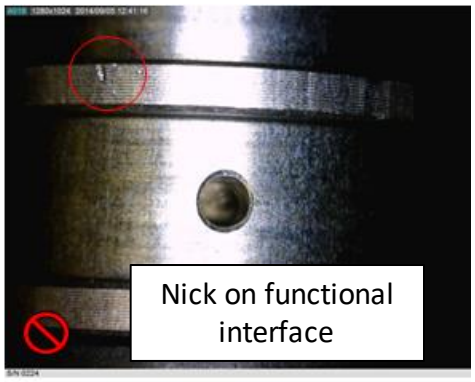
Scratch

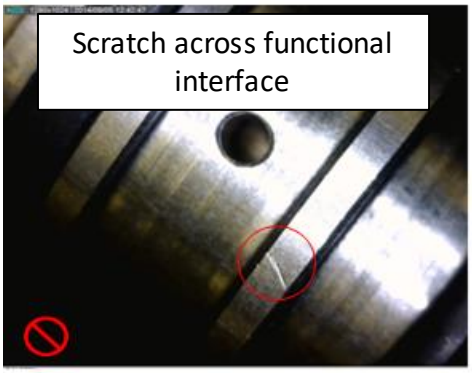
A long, narrow sharp cornered impression caused by movement of a sharp object across a surface

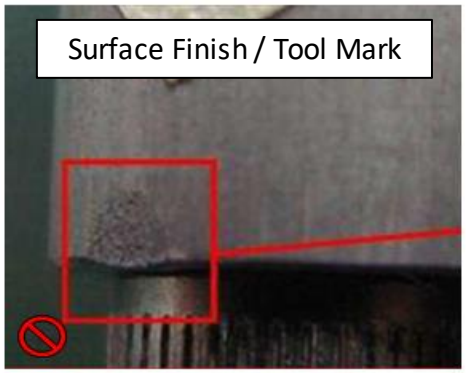
Examples of Unacceptable Machined Surface Conditions:

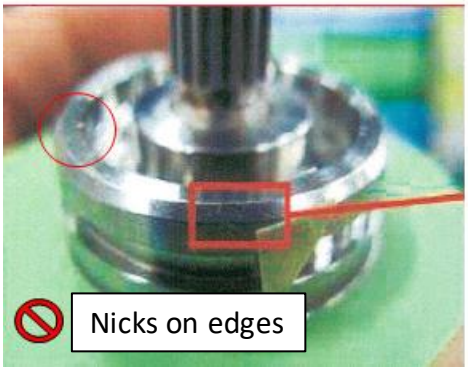
Shown are ***Unacceptable*** conditions.

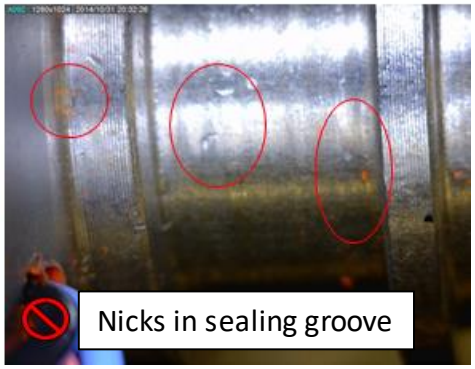












Paint / Sealant / Coated Surfaces:

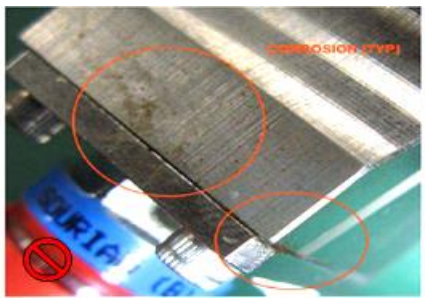
- All sealed surfaces shall be free of dirt, grease, oil, nicks, scratches, voids/pin holes, bubbles, peeling, and cracks.
- The finish shall be smooth with complete uniform coverage without noted blemishes, paint build-up or overspray.

Shown are ***Unacceptable*** conditions:

Rust/Corrosion Surfaces:

- There shall be no rust or corrosion on painted and unpainted surfaces.

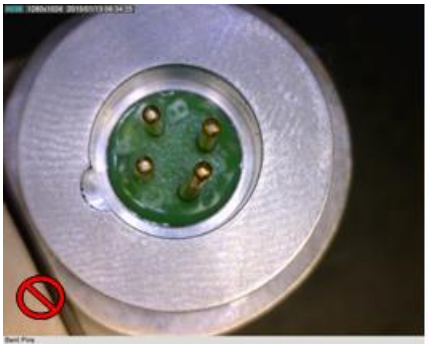
Shown are ***Unacceptable*** conditions:




Electrical Connectors:

- Electrical connectors shall be examined using the unaided eye and a 4x referee magnification. This section is for reference only and is to show typical unacceptable conditions. Electrical connectors shall be evaluated for acceptability against their industry standard specifications.
- There shall be no visible damage to the connector shell or internal contacts (pins).
- The contacts shall not be bent, damaged, or deformed.
- There shall be no flakes or metallic FOD in the connector or contacts (sockets).
- All seals on connector pins shall be intact without damage or voids.
- On circular “MIL” standard connectors, there shall be no damage (tear) of the rubber seal surrounding the metal contacts.
- All contacts shall be seated (no noted recessed contacts).

Shown are ***Unacceptable*** conditions:




Exit Wires/Cable:

- All wiring and heat shrink insulation shall be inspected for damage including insulation tears and cuts. There shall be no exposed wiring except allowed per drawing.
- Potting fill around wires shall have complete fill without voids or holes.

Shown are ***Unacceptable*** conditions:

Stamping / Marking:

- Blurred or incomplete stamping of information.
- Illegible or incorrect data.

Shown are ***Unacceptable*** conditions:

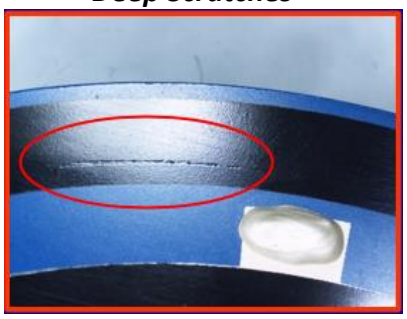
Conductive Track Surface's Marks:

- Check the track is free from FOd.
- Superficial marks (i.e., marks with no apparent depth) are deemed acceptable (e.g., images **a.**).
- Check the track is free from deep scratches, divots & raised surfaces (e.g., images **b.**).

a. Shown are ***Acceptable*** conditions:

b. Shown are ***Unacceptable*** conditions:

Deep Scratches



Divot/Damage

Raised Surface