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## 1. Purpose and Scope:

This standard defines the minimum cosmetic acceptable criteria for all covers, machined & fabricated components, assemblies & enclosures, windows, and plastic injection moulding for all SMT Solutions Segment's machines.

## 2. ASM Application:

This standard replaces the following DSF cosmetic criteria:

- DSF 3.2.3\_Cosmetic\_Acceptable Criteria for Machine Covers
- DSF 3.2.4\_Cosmetic\_Acceptable Criteria for Machined & Fab. Comps
- DSF 3.2.9\_Cosmetic\_Acceptable Criteria for Machine Windows
- DSF 3.2.10\_Cosmetic\_Acceptable Criteria for Inj. Mouldings

This standard applies to each and every external surface of components used on machines, or supplied as a spare by the vendor.

All components must meet the criteria set out in this standard, unless a concession has been granted by ASM SMT Solutions Segment.

Where conflict is found between this standard and any other specification, the priority should be as follows: -

- |   |                                     |
|---|-------------------------------------|
| 1 <sup>st</sup> Customer Specified Requirement. | 3 <sup>rd</sup> Purchasing contract |
| 2 <sup>nd</sup> ASM Engineering specification.  | 4 <sup>th</sup> This standard       |

This standard is not an exhaustive list, any component displaying a non-specified symptom which may cause a customer issue should be reviewed only by authorised ASM personnel.

Only upon this approval can the component be released from ASM or its vendor.

This standard may be **temporarily** relaxed for a surface, if it is concealed by the attachment of another component or not seen during normal use. Only authorised ASM personnel thru waiver process can approve a temporary relaxation.

Through mutual agreement a temporary relaxation can become **permanent** standard practice by implementing the ASM change management procedure which includes updating the engineering drawing.

## 3. Procedure:

### 3.1 Cosmetic Guidelines:

#### 3.1.1 General

- Products must meet requirements specified in the drawing.

#### 3.1.2 Discoloration

- If the difference of colour is visible within 30 seconds, and the item is set to the correct distance it can be considered **reject**.
- If the difference of colour is hardly visible or completely invisible within 30 seconds and the item is set to the correct distance; it can be considered **acceptable**.

- Ensure all cover parts on view for one machine is a colour match.
- A value of  $\Delta E < 1$  between painted part & released colour sample is **acceptable**.  
For detail, see Notes.  
Any other value of more than 1 for a particular colour shall be synchronized and agreed by all sites.

### 3.1.3 Damages

- Without using any optical magnifying equipment, look at the damaged area with the naked eye only. (The Inspector can wear their normal prescription glasses, but these must be clear transparent glasses and not coded glasses or sunglasses).
- If the damage is clearly visible within 30 seconds at the correct distance, the part is **rejected**.
- If the damage is hardly visible or completely invisible within 30 seconds at the correct distance, the part is **acceptable**.

## 3.2 Visual Inspection Rules:

### 3.2.1 Viewing Position

- Mount the item to be inspected onto the machine. If not possible, ensure that it is in the same orientation as used on the machine.
- Ensure the lighting system in the inspection area is normal and that light intensity is in the region of 800 LUX, cool white lighting condition.


### 3.2.2 Viewing Distance and Time

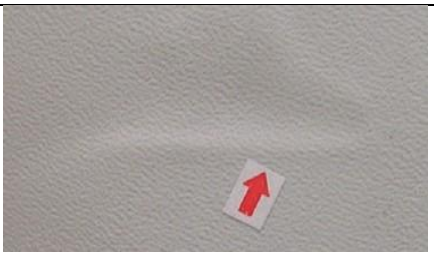
- Determine whether it is a Front Object or Rear Object. **See Glossary.**  
**Front Object:** The distance between the object and the inspector is 1.0 metre.  
**Rear Object:** The distance between the object and the inspector is 1.0 metre.  
**Front/Rear/Inner Object:** The distance between the object and the inspector is 1.0 metre.  
 [see below table]
- Without using any optical magnifying equipment, look at the damaged area with the naked eye only. (The Inspector can wear their normal prescription glasses, but these must be clear transparent glasses and not coded glasses or sunglasses).

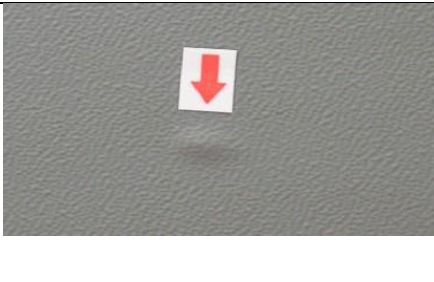
		Machine Cover	Machined & Fabricated Components	Machine Window	Plastic Moulding
Discoloration	Viewing Distance	2.5 m	1.0 m	2.5 m	2.5 m
	Viewing Time	30 s	30 s	30 s	30 s
Damage	Viewing Distance	1.0 m	1.0 m	1.0 m	1.0 m
	Viewing Time	30 s	30 s	30 s	30 s


## 3.3 Acceptable Criteria


### 3.3.1 Machine Cover

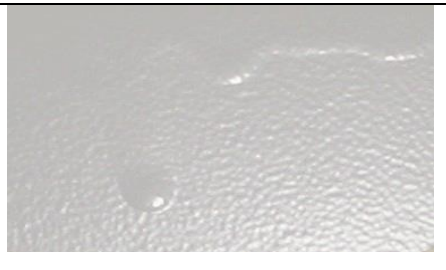
Type of Damage	Straight /Spline	
Length	No greater than 5.0mm in length if approaching maximum width	
Width	No greater than 0.3mm at the largest width measured	
Visual Inspection	See Visual Inspection Rules	
Damage qty allowed	No greater than 3 lines over total outer surface of the panel being checked.	


Type of Damage	Concave Dent (circle / any form)	
Damage Point	No greater Dia 2.0mm	
Damage of any form	No greater than area of 5.0mm x 5.0mm	
Visual Inspection	See Visual Inspection Rules	
Damage qty allowed	No more than 1 ea for the surface under inspection.	


Type of Damage	Convex Protrusion (circle / any form)	
Damage of any form	No greater than area of 5.0mm x 5.0mm	
Height	No greater than 1.0mm	
Visual Inspection	See Visual Inspection Rules	
Damage qty allowed	No more than 1 ea for the surface under inspection.	

Type of Damage	Uneven paint at Edge or Corner (drip / residue / any form)	
Length	No greater than 25.0mm	
Thickness	No greater than 1.5mm	
Visual Inspection	See Visual Inspection Rules	
Damage qty allowed	No greater than 1 ea per panel.	


<b>Type of Damage</b>	<b>Paint chip off</b>	
Damage of any form	Not allowed	
Visual Inspection	-	
Damage qty allowed	Not allowed	


<b>Type of Damage</b>	<b>Uneven surface of painting (rough surface or paint run)</b>	
Damage of any form	Not allowed	
Visual Inspection	-	
Damage qty allowed	Not allowed	


<b>Type of Damage</b>	<b>Loss of Textured Finish (smooth surface)</b>	
Damage of any form	No greater than area of 25mm x 25mm	
Visual Inspection	See Visual Inspection Rules	
Damage qty allowed	No greater than 2ea over the total outer surface of the panel being checked.	


<b>Type of Damage</b>	<b>Discoloration (Difference of color)</b>	
Visual Inspection	See Visual Inspection Rules	

### 3.3.2 Machine Windows

Type of Damage	“Blister”	
Material	Toughened Glass ASM *.* (DSM 3.4.4)	
Visual Inspection	See Visual Inspection Rules	
Damage Quantity Allowed	None	

Type of Damage	“Chip”	
Material	Toughened Glass ASM *.* (DSM 3.4.4)	
Visual Inspection	See Visual Inspection Rules	
Damage Quantity Allowed	None	

Type of Damage	“Scratch”	
Material	Toughened Glass ASM *.* (DSM 3.4.4) P'carbonate Sheet ASM *.* (DSM 3.4.5) Eslon DC Plate ASM *.* (DSM 3.6.2) Perspex ASM *.* (DSM 3.4.1)	
Visual Inspection	See Visual Inspection Rules	
Damage Quantity Allowed	<b>Viewing Area</b> -No greater than 1 scratch, 2.5mm long, 0.2mm wide <b>Non-Viewing Area</b> -No greater than 2 scratches, 5mm long, 0.2mm wide	

Type of Damage	“Patination (Oil Marks)”	
Material	Eslon DC Plate ASM *.* (DSM 3.6.2)	
Visual Inspection	See Visual Inspection Rules	
Damage Quantity Allowed	None	



### 3.3.3 Plastic Injection Mouldings

The visual criteria below shall not cause any potential deterioration of functional and assembly issues e.g. on a fitting assembly or a mating surface.

For moulded parts used in Feeder projects, each case must be discussed with to R&D to assess the risk before released to production. Once approved, moulded parts shall be consistent in appearance, size & material.

- **Flash Control:** (see image 1). Flash & mismatch at parting lines to be 0,3mm max. Holes and apertures containing flash to be within tolerance.
- **Ejector Pins and Gates:** (see images 1& 2). Ejector pin marks shall be flush to 0,3mm max. sub flush (minus) at component profile. Gates shall be trimmed flush to 0,4mm above (plus) or below (minus) at component profile. Except for structural foam moulded components, gates shall be trimmed flush to 0,4mm above (plus) component profile.

Placement of ejector pins, parting line(s) & gate(s) to be agreed with both toolmaker and ASM Engineering / R&D, prior to machining.

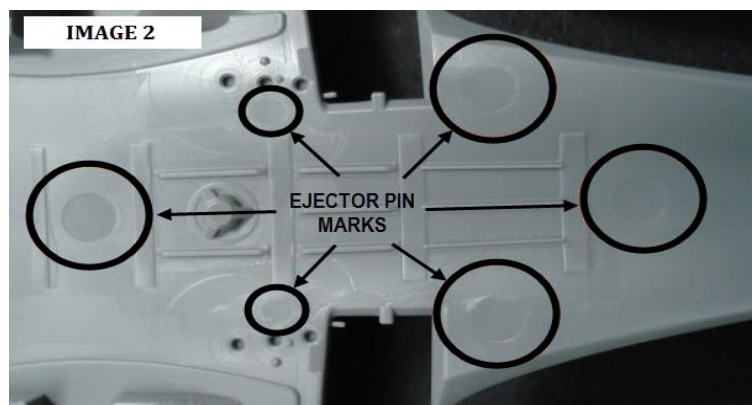
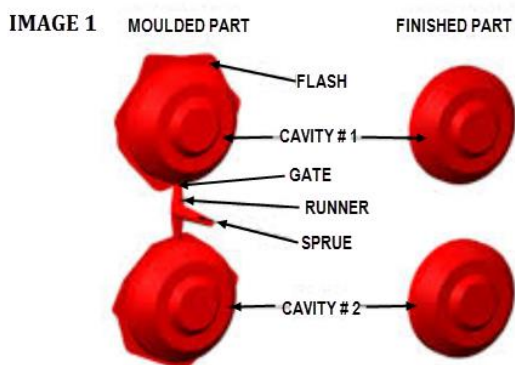
- **Cavity Ident.:** (see image 1)  
For multiple cavity tools, each cavity is to be identified by a unique number.

For example, on a four (4) cavity tool, each individual cavity would be identified by using only one number from the following: 1, 2, 3 & 4.

It is common practise to place the cavity number adjacent to any Part Number. This will be agreed with both toolmaker and ASM Engineering / R&D.

- **Surface Quality:**  
Blemishes such as weld & flow lines or surface imperfections including sinkage, short shot and porosity will need to be agreed by ASM Engineering / R&D prior to dispatch.

- **Colour:**  
The colour of a component is determined by the material formulation and will not normally fluctuate within a batch. Where a difference is noted then the following procedure should be followed to determine acceptability:



### 3.3.4 Machined and Fabricated Components

Refer to comments in chapter **2 ASM Application**, the exception being components that are regularly removed from the machines by customers such as, squeegee blades & mechanisms, ProFlow and USC.

#### 3.3.4.1 Sheet Metal

All allowable defects in this table apply to all sheet metal components with up to 1.0m<sup>2</sup> surface unless otherwise stated on the engineering drawing.

DEFECTS	PAINTED	ANODIZED, GALVANIZED or PLATED	BARE METAL COMPONENTS	REMARKS
Cracks/ Fractures	None	None	None	Excluding normal 'crazed' surface effect when sheet-metal is folded.
Gouges	One Max Dimension: 1,0mm Diameter	One Max Dimension: 1,0mm Diameter	One Max Dimension: 1,0mm Diameter	
Scratches	Two Max Dimension: 0,2mm x 10mm	Two Max Dimension: 0,2mm x 10mm	Two Max Dimension: 0,2mm x 10mm	
Corrosion	None	None	None	Board Clamp foils should have NO corrosion when machine is shipped
Discolouration	Four Max Dimension: 1,0mm Diameter	Four Max Dimension: 1,0mm Diameter	Six Max Dimension: 2,0mm Diameter	Laser cutting burnt edges, heat treatment is acceptable for bare metal components
Foreign Material	Two Max Dimension: 2,0mm x 1,0mm	None	None	
Non -Adhesion	None	None	Not Applicable	
Non – Uniform coverage	None	None	Not Applicable	
Runs (paint)	Two Max Dimension: 25mm x 25mm	Not Applicable	Not Applicable	MMI components to be completely free of 'runs'
<b>Remarks</b>		See figures 1, 2, & 3 for reference		



## 3.3.4.2 Machined Components (Metal: Ferrous and Non-ferrous)

All allowable defects in this table apply to all machined components per surface unless otherwise stated on the engineering drawing.

DEFECTS	PAINTED	ANODIZED, GALVANIZED or PLATED	BARE METAL COMPONENTS	REMARKS
Cracks/ Fractures	None	None	None	
Gouges	One Max Dimension: 1,0mm Diameter	One Max Dimension: 1,0mm Diameter	One Max Dimension: 1,0mm Diameter	
Scratches	Two Max Dimension: 0,2mm x 10mm	Two Max Dimension: 0,2mm x 10mm	Two Max Dimension: 0,2mm x 10mm	
Corrosion	None	None	None	Board Clamp foils should have NO corrosion when machine is shipped
Discolouration	Two Max Dimension: 1,0mm Diameter	One Max Dimension: 1,0mm Diameter	Two Max Dimension: 1,0mm Diameter	Laser cutting burnt edges are acceptable for bare metal components
Foreign Material	Two Max Dimension: 2,0mm x 1,0mm	None	None	
Non -Adhesion	None	None	None	
Non – Uniform coverage	None	None	Not Applicable	
Runs (paint)	Two Max Dimension: 25mm x 25mm	Not Applicable	Not Applicable	MMI components to be completely free of 'runs'
Remarks		See figures 1, 2, & 3 for reference		

### 3.3.4.3 Machined Components (Non-Metallic)

All allowable defects in this table apply to all non-metallic machined components surface unless otherwise stated on the engineering drawing.

DEFECTS	PAINTED	BARE MATERIAL or COMPONENTS	REMARKS
Cracks/ Fractures	None	None	
Gouges	One Max Dimension: 1,0mm Diameter	One Max Dimension: 1,0mm Diameter	
Scratches	Two Max Dimension: 0,2mm x 10mm	Two Max Dimension: 0,2mm x 10mm	
Corrosion	Not Applicable	Not Applicable	
Discolouration	Two Max Dimension: 1,0mm Diameter	Two Max Dimension: 1,0mm Diameter	Differences in colour due to different substrate surface finishes.
Foreign Material	Two Max Dimension: 2,0mm x 1,0mm	None	
Non -Adhesion	None	None	
Non – Uniform coverage	None	Not Applicable	
Runs (paint)	Two Max Dimension: 20mm x 20mm	Not Applicable	MMI components to be completely free of 'runs'
<b>Remarks</b>			

### 3.3.5 ASM Workmanship Standard

**Scratches:** around captive fasteners are to be expected and are acceptable if they are within a 5mm zone of the fastener maximum diameter.

**Scratches:** (straight lines) are acceptable provided they do not exceed the criteria in both chapters: - **ASM Application** and **ASM Acceptable Criteria**

**Plating:** components should be free of **corrosion**, bubbling, peeling, contamination or permanent fingerprints. No attempt should be made to repair a plated layer. If a component shows damage before plating, it will be accepted after it is plated provided it does not exceed the criteria in chapter: - **ASM Acceptable Criteria**

**Discolouration:** Some plated finishes will result in variations of colour over the extent of the surface. This is acceptable provided it does not exceed the criteria in chapter: - **ASM Acceptable Criteria**

Where decorative mechanical finishes are specified (ie: Grit Blasting, Linishing or Circular Grinding) the acceptance criteria will be specified on the engineering drawing.

Discoloration Reference :

Fig. 1; This Finish Is Unacceptable



Fig. 2; This Finish Is Acceptable

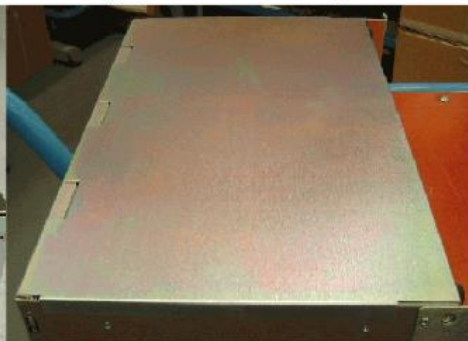
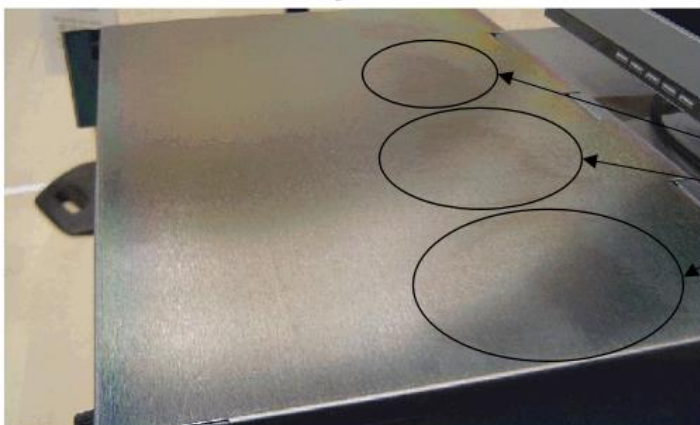


Fig. 3; This Finish Is Questionable



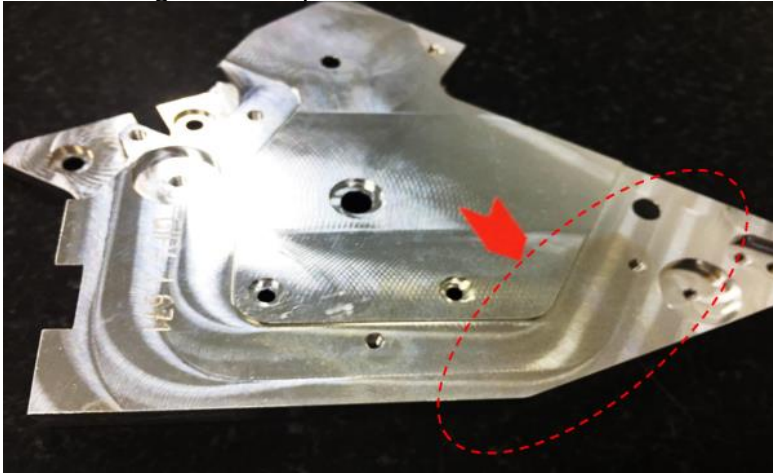
Questionable areas of colour that are not considered as coming of the normal colour variation for the finish being used.

*With this type of surface flaw, an attempt should be made to produce an acceptable finish by applying an Engineering approved surface treatment. If an acceptable improvement is not achieved then the component(s) should be presented the Cell Supervisor, Quality Representative and Product Manager in that order until a decision whether to accept or not has been reached.*

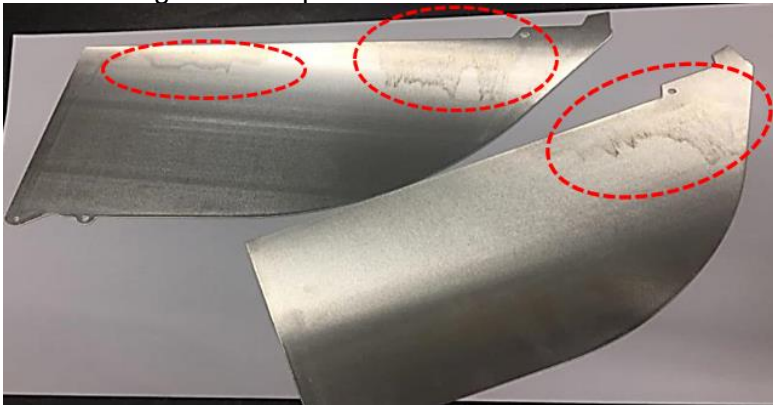
**Additional References:**

**Stain Reference:**

The finishing is unacceptable

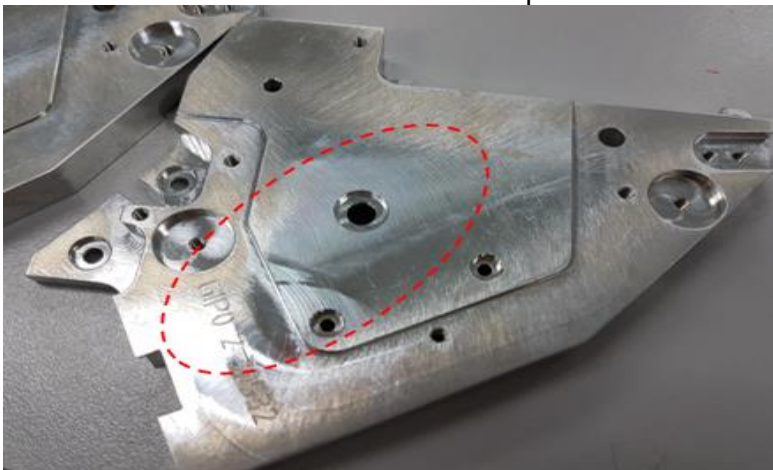


The finishing is unacceptable



**Surface Condition:**

This uneven surface condition is unacceptable



**Scratches Condition:**

These scratches are unacceptable



**Corrosion Condition:**

This corrosion is unacceptable





## 4 Glossary

**Damage:** Any unexpected change to the surface can be labelled as damage that affects its value, purpose & appearance.

**Front Object:** Any part that is frequently seen by the end user is defined as a front object.

**Rear Object:** Parts that do not belong to the front group but can be seen by the end user.

**Inner Object:** Inner side of the covers that can be seen by end-user when opening it.

**Cracks/ Fractures:** Break, split or rupture with or without entire separation.

**Gouges:** Indentations, dings, pits & nicks usually caused by impact.

**Scratches:** Shallow surface grooves & abrasions usually caused by sharp objects.

**Corrosion:** Oxidization of any metal components.

**Discolouration:** Inconsistent surface appearance due to a change from the original colour or plating procedure plus areas of inconsistent surface finish such as a local departure from gloss to matt. An exclusion is applied to the uncontrolled & variable surface discolouration as a result of heat generated by bare metal welding.

**Foreign Material:** Unintended inclusions in a material or coating.

**Runs (paint):** Excessive painting that causes drips.

**Non-Uniform Coverage:** Areas of insufficient or excessive coating or plating, plus small lumps of paint or powder coat which are not constant with the substrate.

**Non-Adhesion:** Lack of adhesion of the coating/plating to the surface or de-lamination of bonded components

**Window:** Any transparent or semi-transparent machine panel which, when closed, allows the operator to see into the machine

**Viewing Area:** The area of the window which is in the operator's (line of sight), whilst viewing the print process.

**Non-Viewing Area:** The area of the window that is not classed as the viewing area.

**Gate:** A small aperture where molten plastic enters to fill the mould cavity.

**Ejector Pin:** Used in the mould tool to remove the moulding.

**Flash:** Excess material that extends from the moulding.

**Weld lines:** A visible line identifying where two flow fronts (cold) meet but do not merge (knit). These lines usually occur around holes or obstructions on the opposite side to the flow and cause local weak areas in the moulded part.

**Flow lines:** Visible semi-circle parallel knit lines rippling out from the gate causing a local weak area in the moulded part.




## 5 Notes

### DIN EN ISO 11664-4/ CIELAB

Colour differences are increasingly being described by means of colour coordinates. A formula is used which combines & compares these coordinates to generate an  $\Delta E$  value (**total** colour difference).  $\Delta E$  (Delta-E) is a single, positive number that represents the 'distance' between the colour sample (standard) and a colour match (painted part). An  $\Delta E$  of 1.0 is the smallest colour difference a human eye can detect.

Traditionally three components have been identified that combine to make a colour:-

- **Lightness.** Tone. The amount of black (0) or white (10) added to a colour.
- **Chroma.** Purity. A 100% saturation means no additional grey therefore the colour is completely pure.
- **Hue.** Colour. Described as an angle in a 360° degree colour palette. 

Each component now has a colour space (tolerance) and this is expressed as a colour coordinate (colorimetric value), which can have a positive or negative value.

- **Lightness.**  $L^*$  ( $L^*$  painted part minus  $L^*$  colour sample) = difference in lightness and darkness (+ = lighter, - = darker).
- **Chroma.**  $a^*$  ( $a^*$  painted part minus  $a^*$  colour sample) = difference in red and green (+ = redder, - = greener)
- **Hue.**  $b^*$  ( $b^*$  painted part minus  $b^*$  colour sample) = difference in yellow and blue (+ = yellower, - = bluer)

To determine the **total** colour difference between the painted part and colour sample the three colour coordinates (**L**, **a** & **b**) from each are identified & recorded using a spectrophotometer. The numerical difference of these coordinate values from the painted part & colour sample are identified as the colour difference. ( $\Delta L$ ,  $\Delta a$  &  $\Delta b$ )

The **total** colour difference is calculated by taking the three values from the colour difference ( $\Delta L$ ,  $\Delta a$  &  $\Delta b$ ) and including them in the following formula:-

$$\Delta E = (\Delta L^2 + \Delta a^2 + \Delta b^2) \div 2 \quad \Delta E = \text{total colour difference}$$

The acceptable total colour difference is  $\Delta E < 1$

