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1.0 PURPOSE

To establish and communicate a standardized method of inspecting parts/product for cosmetic issues in a uniform and subjective way.

2.0 SCOPE

This procedure shall be used to inspect all the parts/product, unless given different specifications by the customer.

3.0 Defect Definitions

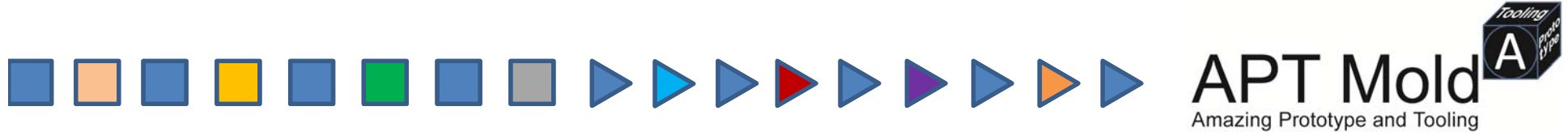
Burn marks: Brown to black, irregular and locally variable discoloration of the molded part, also see gas marks.

Gas marks: Dark discolored streaks caused by incomplete venting of gases generated during the molding cycle.

Short shot(non-fill): Missing plastic due to incomplete filling of the mold cavity. Parts are not completely formed, generally at the ends of flow paths or at thin sections, Can usually be identified by smooth, shiny and rounded surfaces.

Sink mark: Surface depression caused by non uniform material solidification and shrinkage, most often noted at interface between differing wall thicknesses. Distinct, localized hollows in the surface, generally found opposite ribs, at thicker sections, cores, weld lines, constrictions, hot runner nozzles and the end of flow paths.

Flash: Excess plastic at parting line or mating surface of the mold, Normally very thin and flat protrusion of plastic along an edge of a part. Can also appear as a very thin string or thread of plastic away from the edge of a part(string flash). Often found at vents, Knock outs and other shut-off areas.



Scratch/Scuff mark: Surface imperfection due to abrasion that removes small amounts of material, Depth is not measurable, Differs from scratch in mold which leaves a consistent mark, scratches running in the de-molding direction, also visible as matt streaks on high-gloss surfaces.

Jetting mark: Generally serpentine strand of the melt first injected into the mold, found near the sprue or at constricted sections, and visible on the part surface.

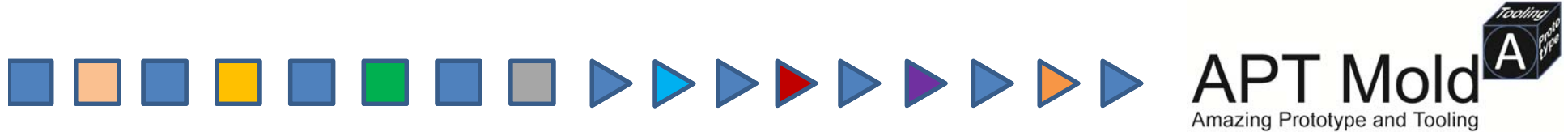
Weld lines: Witness line where 2 or more fronts of molten plastic converge, also called knit lines or flow lines, the weld around the holes, the line between the injection gate.

Wall thickness varying mark: The marks can be viewed in the thickness varying and transition area, it generally happen on the recess area, thick wall -thin wall-thick wall.

Warping: Molded parts do not match specification drawing, suffer warpage at corners or do not fit accurately.

VOIDS, Bubbles: Round or elongated bubbles generally only visible in transparent and translucent parts, May appear as a bulge or protrusion in an opaque part.

Silver streaks: Elongated silver streaks.



Shine: Glossy or shiny areas on textured surface. Usually caused by a dirty or worn mold. Can also be caused by lack of sufficient pressure to properly replicate texture in the mold.

Splay: Off colored streaking. Usually appears silver-like. Splay is caused by moisture in the material or thermal degradation of the resin processing. A Similar look can be caused by cold material skipping across the surface during a fast fill. This is commonly called “Jetting”.

Gouge: Surface imperfection due to abrasion that removes small amounts of material, Depth is measurable.

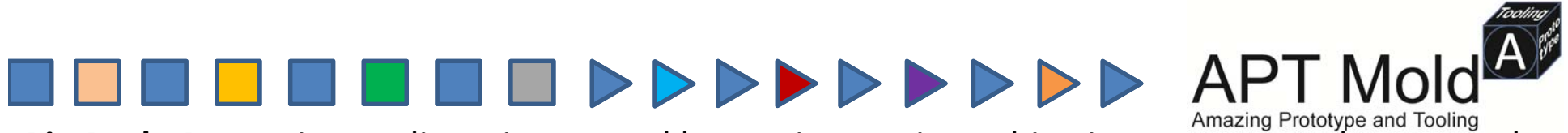
Grease: Any type of machine lubrication on the surface of a part.

Haze: Cloudiness on an otherwise transparent part.

Cold Slug: First material to enter mold during injection. Solid or semi-solid, this material leaves a distinct border with adjacent melted material similar in appearance to weld lines.

Haze: Cloudiness on an otherwise transparent part.

Specks: Small discolored points of matter embedded in the surface. Typically black, caused by material contamination or material degradation.



Pin Push: Protrusion or distortion caused by an ejector pin pushing into part more than normal. The protrusion is most evident on the surface opposite the ejector pin.

Orange Peel: Rippled or mottled appearance view able as concentric lines. Caused by under-pressurizing. Orange peel is often the first sign of possible sink or shorting.

Nicks: Like gouges but of short length. Cause by impact rather than abrasion.

Marbling: Colored streaks caused by incomplete mixing of 2 different colored plastics. Also referred to as streaking.

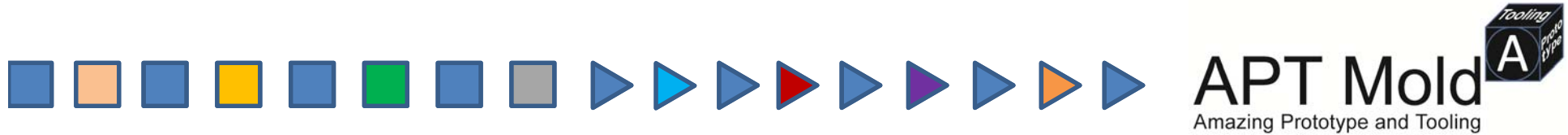
Insert Problems (Not a true “cosmetic” defect. More functional than cosmetic)
Errors related to the installation of inserts into plastic parts. Inserts can be set too high or too low in a socket or boss. They can also be damaged or misaligned and may even be missing.

Cracking: Stress induced splitting or fissures causing separation of material.

Crazing: Multiple tiny cracks due to stress exerted on the part.

Delamination: Separation(peeling) of layers of plastic.

Discoloration: Any change from the original color standard. Unintended, Inconsistent color.⁵



Pulling: Part distortion caused from plastic catching in the mold when the part is ejected.

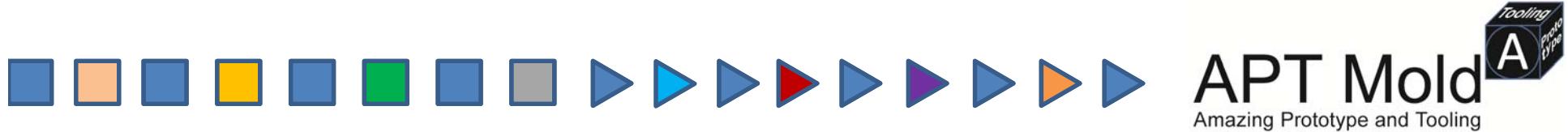
Pitting: Crater-like imperfections on the surface of the part.

Drag Marks: Clusters of scratches from plastic dragging against mold details when a part is ejected from a mold.

Contamination: Large areas of discoloration from foreign matter or foreign material embedded in the surface of a part.

Blush: Discoloration or change in gloss. Generally occurring at gate locations or abrupt changes in wall thickness.

Broken: General damage. For example bent and/or broken tabs or ribs.



Bleeding(Paint or decoration): Evidence of one color overlapping or altering another color(painting). Spreading of pigment beyond the intended boundaries(silk screen, printing).

Fill-ins(print or silk screen): An excessive use of ink that alters the form of screened or printed feature. Placement of ink where no ink should be.

Flow Marks(paint or silk screen): Waviness of edge or excessive linear junction between two surfaces of ink or paint.

Lint(paint): Any unintended foreign substance in the coating or on the surface.

Non-adhesion(Painted or decorated): Lack of adequate sticking of paint, print or any coating to the plastic surface.

Runs(painting or printing): Dripping or sagging of paint or ink. Movement of ink beyond intended surfaces. Usually caused by too much or too thick paint or ink.

Smearing(Paint or Ink): Similar to bleeding. Excess ink or paint in areas that should be free of ink or paint. Smearing is due to rubbing of surface before adequately dried.

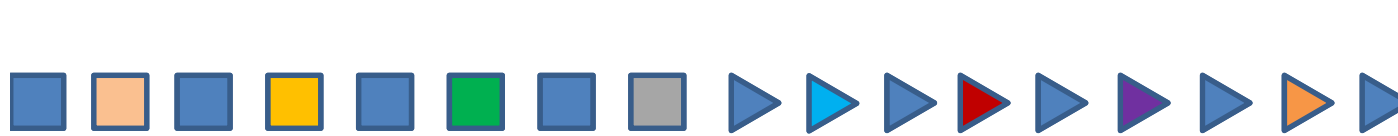
4.0 Work Instructions

4.1 At time of RFQ, the Sales Engineer and customer will review the product and determine surface classification (see sections 5.0 for more information on part classification).

4.2 After these surfaces have been reviewed and agreed upon with the customer, the internal controlled prints will note the corresponding surface classification.

4.3 During the fabrication of product, per Work Instruction Form, auditor will verify that product conforms to this specification.

4.4 If product does not conform to this specification, defect will be documented on the Inspection History Form and Quality will determine part disposition.



5.0 Surface Identification and cosmetic specification classification.

5.1 General- For components or assemblies , cosmetic inspection shall use the Time and Distance Inspection procedure described below (Table 1) and shall rely on the judgement of trained auditor and suppliers. If flaws are noticeable within this specification, refer to the Cosmetic Reference Standard (Table 2). This added specification will assist our trained auditor in making an accept/ reject decision. If the product does not conform to this specification, product will be placed on hold.

5.2 Surface finish:

Grade 1

Highly polished(e.g.SPI-B1 or lower).

Clear transparent.

Fluid contact-(Primarily applies to medical parts).

Grade 2

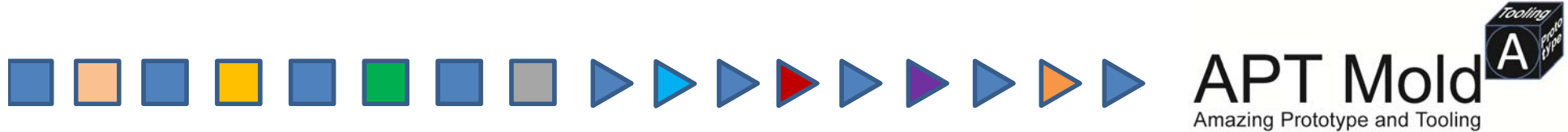
Low grade polish, non-textured: (e.g.SPI-B2 or higher).

Textured.

Clear translucent.

Grade 3

Painted parts.



Grade 4

Ink stamped, printed, silk screened.

Other decorative processes.

5.3 Cosmetic Class Codes- The cosmetic class codes used in this Standard use letters from “A” through “D”.

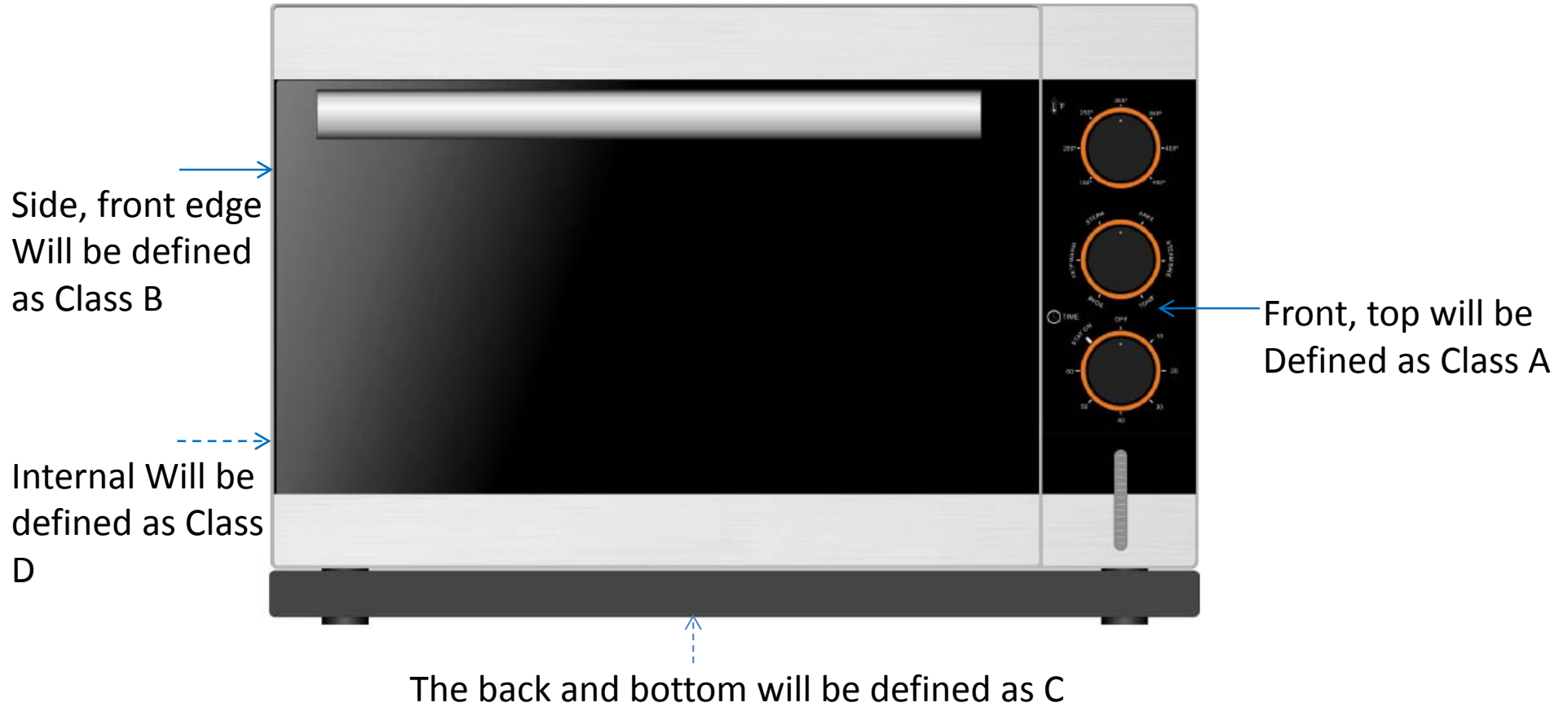
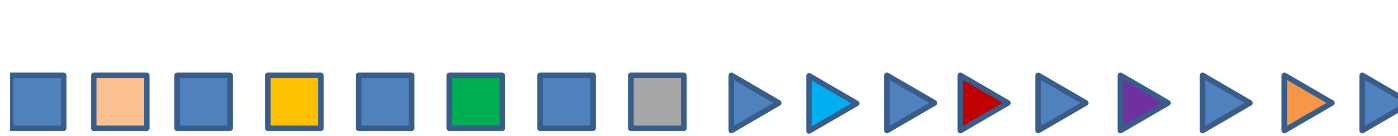
Class “A” is reserved for the top or front, most often viewed surface.

Class “B” is generally the front edge and sides of a part. Not viewed as often as an “A” surface but easily seen by user.

Class “C” is generally specified for most often, the back and bottom surface.

Class “D” is generally internal surface. Normally D surfaces are not inspected for cosmetic attributes. Where, necessary, D surface inspection will be specified as an exception.

5.4 Application- “External” applications include front panels, covers, and frames that are readily visible in the final assembly. “Internal” components are generally seen only by assembly and technical personnel and are less important cosmetically. Some components, such as the inside of a door, may have both an internal and external application. This will be our default code unless directed otherwise by the customer.



6.0 Viewing Conditions- Parts and products shall be inspected under the following conditions.

Standard viewing condition

A. Lighting intensity

All quality decisions of cosmetic acceptability will be made under normal lighting conditions(80-120 foot-candles) in white fluorescent light.

B. Viewing Angle

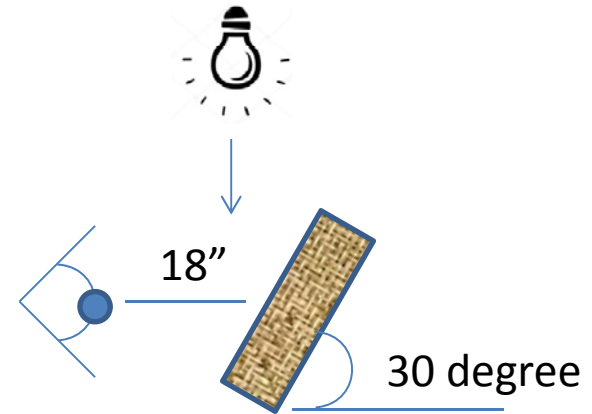
All viewing will take place with direct overhead lighting. Viewing angle is dependent on surface classification.

In every case, parts will be held such that the light is NOT REFLECTED directly to the viewer.

A surface- Hold part 30° from the horizontal plane.

Part is in direct line with your eyes.

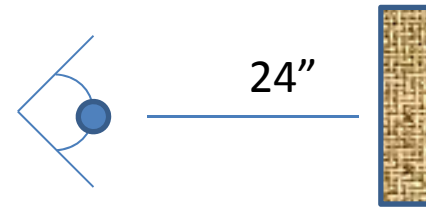
ROTATE part 30° to the right and to the left about the vertical axis.



B surface- Hold part 90° from the horizontal plane.

Part is in direct line with your eyes.

DO NOT Rotate the parts.

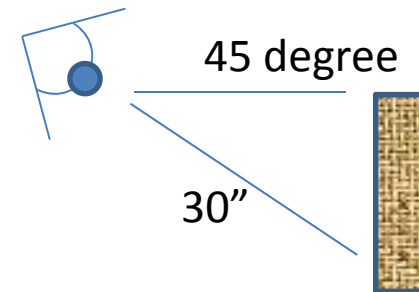


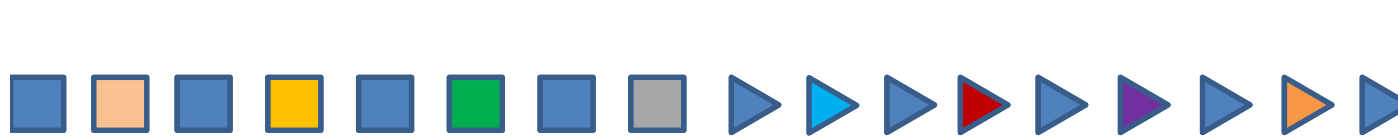
C surface- Hold part 90° from the horizontal plane.

Part is NOT in direct line with your eyes.

Part is held 45 below the plane of your eyes.

DO NOT rotate the part.





Viewing Distance

A surface-18 inches

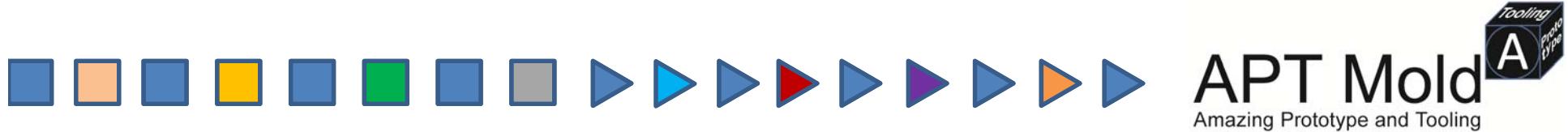
B surface-24 inches

C surface-30 inches

Inspection interval(time)

Surface area	A Surfaces	Non-A surfaces
$\leq 4 \text{ in}^2$ (2" x 2")	2 sec.	1 sec.
4-16 in^2 (4" x 4")	4 sec.	2 sec.
16-64 in^2 (8" x 8")	6 sec.	3 sec.
64-144 in^2 (12" x 12")	8 sec.	4 sec.
$>144 \text{ in}^2$ (12" x 12")	10 sec.	5 sec.

Table 1



Color Matching

Decisions regarding color matching are made by comparison to known standards using a spectrophotometer, color meter or suitable color matching light booth.

Color standards and tolerances shall be provided by the customer. In the absence of a customer supplied color standard, standards shall be developed based upon the material manufacturer's color chip set and tolerances shall be set using a Delta E limit of 2.00, unless otherwise stated by the customer.

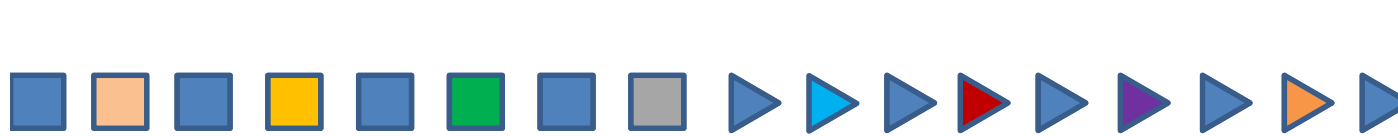
Surface finish and texture matching.

Judgement as to the conformance of surface finish is to be made by comparing a part to an SPI Mold Finish Guide plaque. Comparison is by eye unless otherwise specified by the customer.

Judgement as to the conformance of surface texture is to be made by comparing a part to a Mold-Tech texture plaque. Comparison is by eye unless otherwise specified by the customer.

ADHESION

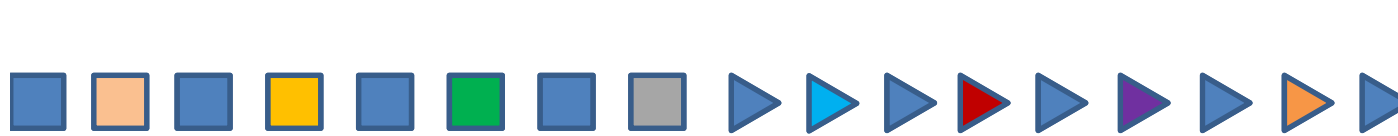
Adhesion requirements pertain to printed, painted or other decorative finishes applied to the surface of a plastic part. The applied finish must withstand a tape test, whereby a piece of pressure sensitive type (Scotch number 610 or equivalent adhesive strength) is applied across the finished surface. The tape is then removed by rapidly pulling the tape at a 90 degree angle to the part surface. The tape is examined for evidence of finish coat removal. There should be no evidence of finish coat on the tape.



Grade 1-(Highly polished, clear transparent, fluid contact)

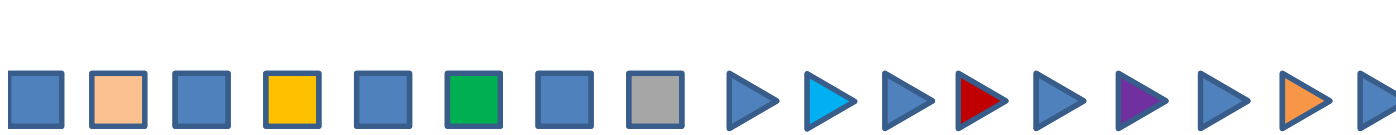
<u>Cosmetic Class</u>		A	B	C
Weld lines & Blush		Limits for blush and weld lines are established in agreement with customer and help based upon limit samples.		
Sink		None allowed	0.003" max.	0.010" max.
Specks & Bubbles	Accept if	Less than or equal to 0.010" No closer than 1 inch.	Less than or equal to 0.010" No closer than 1 inch.	Less than or equal to 0.012" No closer than 1 inch.
	Allowable range	0.010"-0.025". Allow 1 per 16 inch ² (4" x 4").	0.010"-0.025". Allow 2 per 16 inch ² (4" x 4") No closer than 2 inches.	0.012"-0.030". Allow 4 per 16 inch ² (4" x 4") No closer than 1 inch.
	Reject if	Greater than 0.025".	Greater than 0.025".	Greater than 0.030".

Table 2



<u>Cosmetic Class</u>		A	B	C
Scratches	Accept if	0.100" or less in length. Allow 1 per 16 inch ² (4" x 4").	0.150" or less in length. Allow 1 per 16 inch ² (4" x 4").	0.300" or less in length. Allow 2 per 16 inch ² (4" x 4") No closer than 1 inch.
	Reject if	Greater than 0.100".	Greater than 0.150".	Greater than 0.300".
Splay Burns Gas Marks Marbling Orange Peel Non-uniform texture Pitting Cracking Crazing Delamination Cold slugs		None Allowed	None Allowed	Refer to limit samples or note exceptions in Quality Plan.

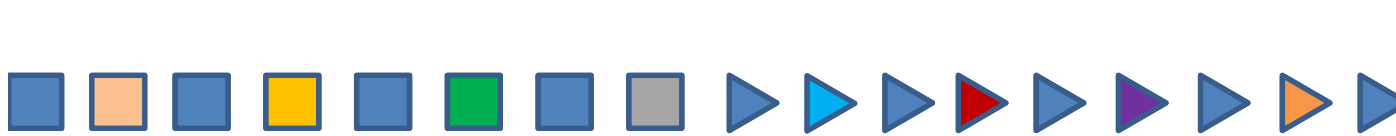
Table 2



Grade 2-(Low grade polish, textured, clear translucent)

<u>Cosmetic Class</u>		A	B	C
Weld lines & Blush		Limits for blush and weld lines are established in agreement with customer and help based upon limit samples.		
Sink		None allowed	0.005" max.	0.015" max.
Specks & Bubbles	Accept if	Less than or equal to 0.010" No closer than 1 inch.	Less than or equal to 0.010" No closer than 1 inch.	Less than or equal to 0.015" No closer than 1 inch.
	Allowable range	0.010"-0.030". Allow 1 per 16 inch ² (4" x 4").	0.010"-0.030". Allow 2 per 16 inch ² (4" x 4") No closer than 2 inches.	0.015"-0.040". Allow 3 per 16 inch ² (4" x 4") No closer than 1 inch.
	Reject if	Greater than 0.030".	Greater than 0.030".	Greater than 0.040".

Table 2



<u>Cosmetic Class</u>		A	B	C
Scratches	Accept if	0.150" or less in length. Allow 1 per 16 inch ² (4" x 4").	0.200" or less in length. Allow 1 per 16 inch ² (4" x 4").	0.300" or less in length. Allow 3 per 16 inch ² (4" x 4") No closer than 1 inch.
	Reject if	Greater than 0.150".	Greater than 0.200".	Greater than 0.300".
Splay Burns Gas Marks Marbling Orange Peel Non-uniform texture Pitting Cracking Crazing Delamination Cold slugs		None Allowed	None Allowed	Refer to limit samples or note exceptions in Quality Plan.

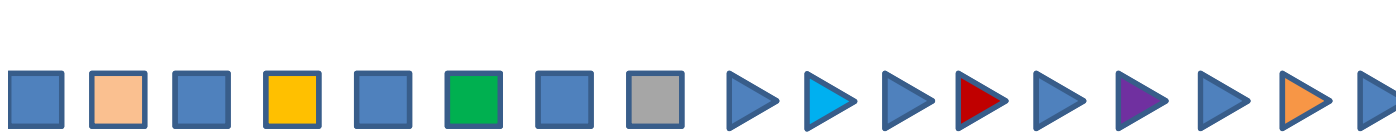
Table 2



Grade 3-(Painted/Finished parts)

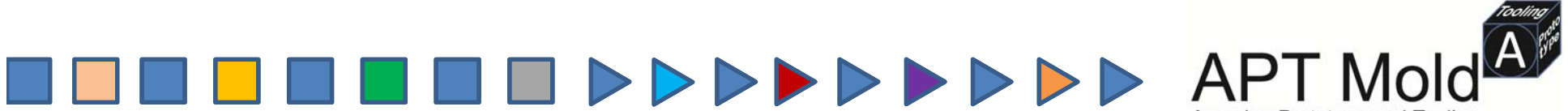
<u>Cosmetic Class</u>		A	B	C
Specks, Discoloration, Glossiness	Accept if	Less than or equal to 0.010" No closer than 1 inch.	Less than or equal to 0.015" No closer than 1 inch.	Less than or equal to 0.015".
	Allowable range	0.010"-0.020". Allow 2 per 16 inch ² (4" x 4").	0.015"-0.040". Allow 4 per 16 inch ² (4" x 4") No closer than 2 inches.	0.015"-0.050". Allow 6 per 16 inch ² (4" x 4") No closer than 1 inch.
	Reject if	Greater than 0.020".	Greater than 0.040".	Greater than 0.050".

Table 2



<u>Cosmetic Class</u>		A	B	C
Scratches, Lint	Accept if	0.010" x 0.030" or less. Allow 2 per 16 inch ² (4" x 4") No closer than 1 inch.	0.020" x 0.050" or less. Allow 4 per 16 inch ² (4" x 4") No closer than 1 inch.	0.020" x 0.500" or less. Allow 4 per 16 inch ² (4" x 4") No closer than 1 inch.
	Reject if	Greater than 0.010" x 0.030".	Greater than 0.020" x 0.050".	Greater than 0.020" x 0.500".
Marks, Runs	Accept if	None	0.020" x 0.050" or less. Allow 2 per 16 inch ² (4" x 4") No closer than 1 inch.	0.020" x 0.500" or less. Allow 4 per 16 inch ² (4" x 4") No closer than 1 inch.
	Reject if	Any found	Greater than 0.020" x 0.050".	Greater than 0.020" x 0.500".
Non-adhesion or Non-uniform coverage.	Accept if	None	0.125" or less. Allow 2 per 16 inch ² (4" x 4") No closer than 1 inch.	0.250" or less. Allow 4 per 16 inch ² (4" x 4") No closer than 1 inch.
	Reject if	Any found	Greater than 0.125".	Greater than 0.250".

Table 2



Grade 4-(Decorated parts-Stamped, Printed, Silk screened, in-mold....etc.)

<u>Cosmetic Class</u>		A	B	C
Specks, Voids, Fillings	Accept if	Less than or equal to 0.010" No closer than 1 inch.	Less than or equal to 0.015" No closer than 1 inch.	Less than or equal to 0.025".
	Allowable range	0.010"-0.020". Allow 2 per 16 inch ² (4" x 4") No closer than 2 inches.	0.015"-0.030". Allow 3 per 16 inch ² (4" x 4") No closer than 1 inch.	0.025"-0.050". Allow 5 per 16 inch ² (4" x 4") No closer than 1 inch.
	Reject if	Greater than 0.020".	Greater than 0.030".	Greater than 0.050".
Flow marks, Inconsistencies	Accept if	None allowed	0.020" or less. Allow 2 per surface No closer than 1 inch.	0.050" or less. Allow 4 per surface No closer than 1 inch.
	Reject if	Any found	Greater than 0.020".	Greater than 0.050".

Table 2



<u>Cosmetic Class</u>		A	B	C
Smearing, Bleeding, Haze.	Accept if	None allowed	0.020" or less. Allow 1 per surface No closer than 1 inch.	0.050" or less. Allow 2 per surface No closer than 1 inch.
	Reject if	Any found	Greater than 0.020".	Greater than 0.050".

Table 2