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Introduction:

Requirement for aluminium profiles with high quality surface finish has increased substantially in the Indian market. A key component of this demand is the furniture / interior design industry where aluminium profiles are used in a wide array of products such as wall partitions, handles, door sliding etc. Given the aesthetic appeal; a high quality surface finish is important.

While Indian aluminum extrusion manufacturers fulfill some of the demand; a significant portion is serviced by China and Middle East (GCC). There are multiple reasons for presence of foreign players in this highly customized domestic market; with a major reason being short supply of domestically produced high quality profiles. High quality surface finish is a visual attribute which does not have numerical tests/ statistical data to test the quality.

In this article; we will define some of

Manufacturing High Quality Surface Finish Aluminium Profiles

the most prominent surface defects which are observed on an aluminum profile.

Furthermore we will highlight the steps taken by R. Y. Extrusion (“RY”) to reduce such defects. I have always believed in Henry Ford’s principle that “Quality means doing it right, when no one is looking”. In continuation of that thought, we will talk about seven surface finish defects: 1) Die Lines 2) Pick-Up Defects 3) White Lines 4) Graphite Lines 5) Hot Spots 6) Hot Rub Marks 7) Horizontal Stains and Oil Patches. The definitions of seven defects used in this article have been derived from the work of “Product Defects in Aluminium Extrusion and its Impact on Operation Cost” [1].

“ *Quality means doing it right, when no one is looking* ”
— Henry Ford

What is high quality surface finish:

High quality surface finish extrusions are those which are devoid of die lines, scratches, marks and other defects mentioned above. Additionally, the profile

should adhere to the specified dimensions and hardness metrics.

Seven Surface Finish Defects

1. Die Lines: Die lines and pickup defects are the primary reason for a lower quality surface finish. As per the definition of The Aluminium Association, die lines are “Longitudinal depressions or protrusion formed on the surface”. It is the roughness which is felt while running ones nails perpendicularly to the length of the profile. They run throughout the length of the profile and are visible post anodizing as well. A combination of die nitriding, die polishing and die designing should be used to reduce die lines.

At RY, we employ a molten nitriding furnace, followed by manual die polishing to ensure a smooth die surface finish. Furthermore, we ensure adequate die land length by employing some of the best die-makers in the country. As per “Extrusion of Aluminium Alloys” by T. Sheppard, a correct size of die land length ensures that the “entire land length is choked, preventing the introduction of oxygen to the virgin surface; the resultant prevention

of an aluminium oxide film having the propensity to score the extrudate surface". In other words, a die designed with the correct lip-length, reduces oxidation and ensures further reduction in die lines. We are also experimenting with usage of Boron Nitride sprays, post polishing, to further increase surface finish quality.

2. Pickup Defects: As opposed to die lines which run throughout the profile, pickup defects are short lines, 1 to 2 cm long ending in speck of fine aluminium debris. When felt with a light touch of hand such a profile feels of small grains protruding out of the profile.

Pick-up defects can be reduced by removing foreign particles from the molten material by employing adequate drossing methods. At RY, we utilize a uniquely designed nitrogen bubbling process which creates the right mixture of inert nitrogen along with flux, which is bubbled evenly throughout the molten metal, ensuring removal of foreign particles and reduction in pick-up lines.

3. White Lines: These are whitish lines running along the length of the entire aluminium profile and appear a markedly lighter color from the rest of the extruded surface. This anomaly is usually caused due to uneven billet temperature in the log heater/billet heater. At RY, we employ an automated three chamber log heater with continuous temperature reporting. This ensures that a drop in chamber temperature and subsequent drop in billet temperature is immediately rectified. As a measure of last resort, profiles with white lines are discarded during quality control.

4. Graphite / Run-out Lines: Graphite lines are black lines that smudge/rub-off on the aluminium surface when rubbed. Graphite lines are usually observed in heavier sections which are often used for partitions and doors. They primarily occur because of usage of graphite conveyor rollers on the run-out table. Although run-out marks usually wash off during anodizing, they might remain visible if they are significantly



larger in size and dark. At RY, we utilize high temperature felt rollers (600 degree Celsius) for 90 percent of the run-out table. While high temperature felt rollers add to the cost of maintenance, they greatly enhance the surface finish quality of the extruded profile.

5. Hot Spots: Hot spots are dark rough patches appearing on the side of the profile at random intervals. As opposed to lines which are visible on the extruded profile, hot spots are visible post caustic etching. Hot spots are usually a result of uneven cooling because of extruded profile touching a cool surface during extrusion. At RY, we deploy 18 turbo fans along the length of the run-out table to

R.Y Extrusion is one of the few players in Mumbai market to utilize homogenized logs directly imported from NALCO, and not utilize in-house own smelting furnace

ensure uniform and adequate cooling.

6. Hot Run Marks: Hot run marks are usually observed in multi-cavity dies, where more than one section of the same profile is extruded at the same time from the same die. This results in hot surfaces of the two sections rubbing against each other. Multi cavity dies hurt product quality at the cost of productivity. At RY, we provide customers with the choice to design single cavity dies to avoid any hot rub marks. In case multicavity dies are necessary (as with smaller sections) we place adequate spacers in the run out table to prevent hot profiles from rubbing and marking against each other.

7. Horizontal Stains and oil patches: While all other surface defects run along the length of the profile, at times there are micro scratches running horizontally to the surfaces of the profiles. These are caused by finish cutting chips which stick to the inspection table after coming out of the finish cutting machine. Similarly the cutting oil used during finish cutting also tends to get smeared onto aluminium profiles, and forms brownish streaks, or patches post ageing. At RY, we deploy a

powerful aluminium chip/dust collection machine. Furthermore, we regularly change hand gloves worn by workers to reduce oil smudges / patches. Also, inspection table felts are cleaned daily to remove any excess chips which might have gotten stuck to the extrusion felts, thus reducing horizontal stains.

Closely monitoring each of these defects has allowed R.Y. Extrusion to drastically reduce surface finish rejections and to increase overall surface finish quality. We are now seen as a dominant quality player in the market and are competing with international players. We have carved a niche in high quality surface finish products in Western India. Furthermore we are one of the only players in Mumbai market to utilize homogenized logs directly imported from NALCO (National Aluminium Corporation), to enhance product quality.

About: About: R.Y. Extrusion Pvt. Ltd., is a premier aluminium extrusion manufacturing firm, based out of Mumbai. We provide aluminium profiles to leading industrial players in automotive, architectural, pharmaceutical, modular furniture, electrical conductors and solar industry. R.Y. Extrusion Pvt. Ltd. operates a three million dollar, one lac square feet, ISO certified, automated facility and is the closest aluminium extrusion plant to both Mumbai market and Mumbai port. We currently manufacture all profiles of 6063, 6061 and EC alloys ranging from 5mm to 125mm cross sectional diameter.

Reference:

1. "Product Defects in Aluminium Extrusion and Its Impact On Operational Cost" A.F.M Arif, A.K. Sheikh, S.Z. Qamar, M.K. Raza, K.M. Al-Fuhaid. Mechanical Engineering Department, KFUPM, Saudi Arabia.

2. "Extrusion of aluminium hollow pipes: seam weld quality assessment via numerical simulation". Silvia Bozzi, Maurizio Vedani, Daniele Lotti, Giuseppe Passoni Hydraulic Lab. - DIIAR, Politecnico di Milano, Milano, Italy. Department of Mechanical Engineering, Politecnico di Milano, Milano, Italy.