



NATIONAL EXTRUSION & MANUFACTURING CO.

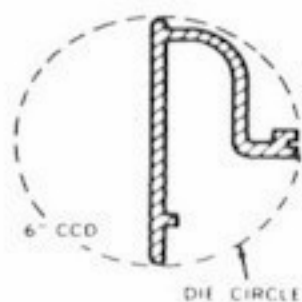
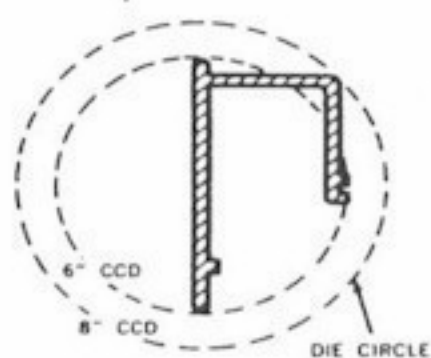
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Design Tips - Page One

INSTEAD OF THIS

CONSIDER THIS

WHY



KEEP CIRCUMSCRIBING DIAMETER (CCD) SMALL

Large CCD requires bigger press, more care. Metals tend to flow slower as distance from the die center increases.

Thin sections near periphery of a large die need special handling. Extruded aluminum shapes to 36" CCD are possible, but a 12" CCD is generally considered the maximum commercial size. Most aluminum extrusions are less than 6" CCD.



SMOOTH ALL TRANSITIONS

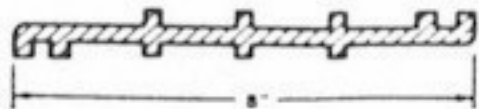
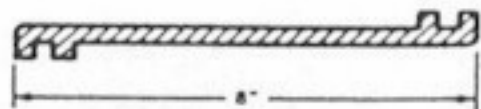
Transitions should be streamlined by a generous radius at any thick-thin junction.



KEEP WALL THICKNESS UNIFORM

The preceding shape can be further improved by maintaining uniform wall thickness.

In addition to using more metal, thick-thin junctions give rise to distortion, die breakage or surface defects on the extrusion.



RIBS HELP STRAIGHTENING OPERATION

Wide, thin sections can be hard to straighten after extrusion. Ribs help prevent twisting.

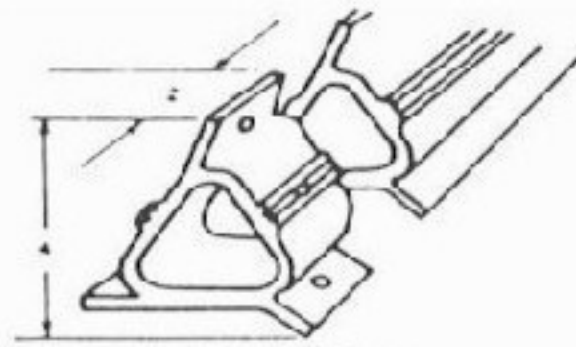
Design Tips - Page Two

INSTEAD OF THIS

CONSIDER THIS

WHY

MACHINING FROM BAR STOCK



Tripod Part

Where a component can be redesigned so it has a symmetrical shape in one plane, it may be possible to fabricate it as a cut-off extrusion.

SAND CASTINGS

They are generally inexpensive, and tooling costs for any extrusion are relatively low (\$800 for simple dies to over \$1500 for a complex die).

STAMPINGS



Collar or
Hose Clamp

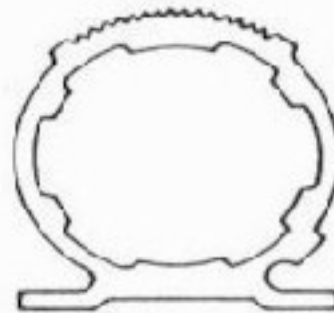


Hand Wheel

FORMING

WELDMENTS

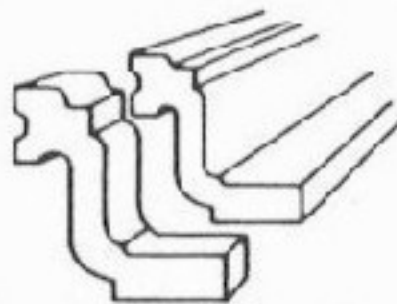
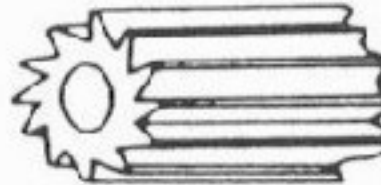
Small
Motor
Housing



Gear

In addition to the components shown, cut-off extrusions have been used to make heat sinks, window handles, door hinges, curved ornamental decorative work such as large initial letters for aluminum storm doors, decorative moldings for hi-fi or appliances, small box covers, drawer pulls and even camera bodies.

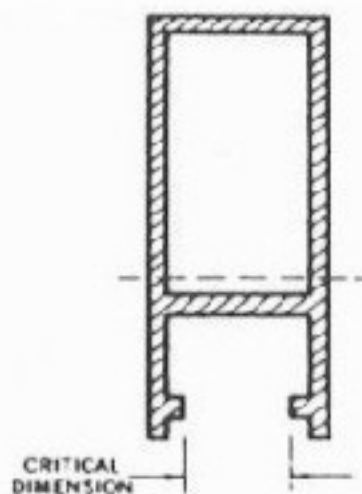
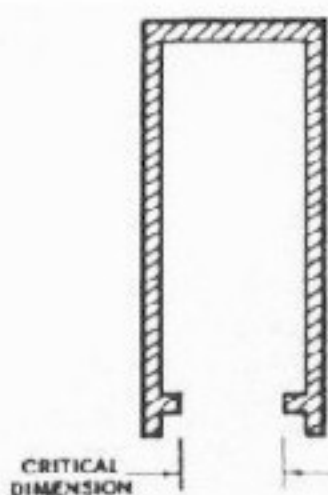
HOBBLING



Mounting Bracket

WEB GIVES BETTER DIMENSIONAL CONTROL

Metal dimensions are more easily held than gap or angle dimensions. Web also allows thinner wall sections in this example.



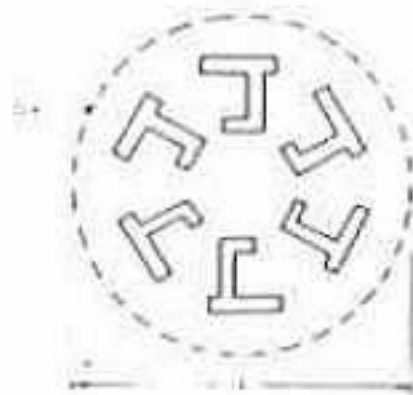
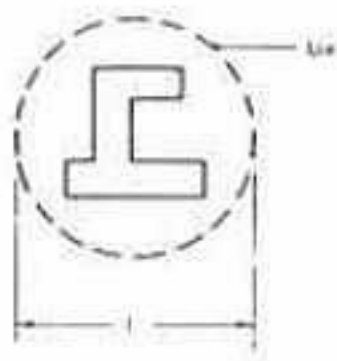
The hollow condition of the "re-designed" part can be avoided by making the component in two pieces as shown by the dotted line.



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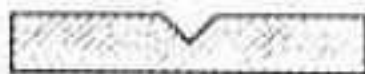
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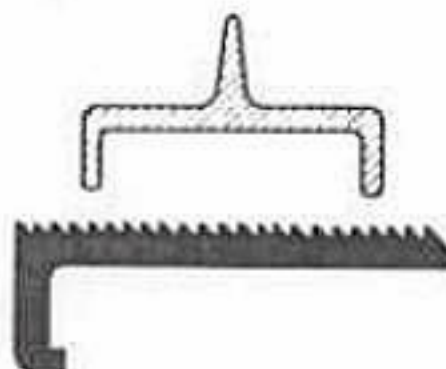
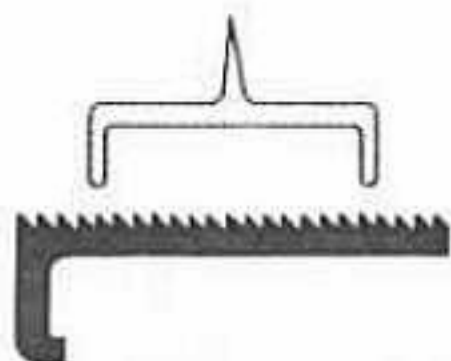
MULTIPLE HOLE DIES

When parts are small and can be arranged symmetrically, a multiple hole die can yield savings by increasing production and distributing die wear on long runs.



BUILT IN INDEXING MARK

Shallow extruded grooves make drilling, punching, assembly easier by eliminating the need for centerpunching. Index groove can also be used to help identify pieces that are similar in appearance, or to distinguish an inside vs. an outside surface.



AVOID KNIFE EDGES

A knife edge when extruded will appear wavy. Change the profile to blunt or rounded point.

Serrations on a step plate should be rounded rather than sharp to retain a good appearance for a longer time.



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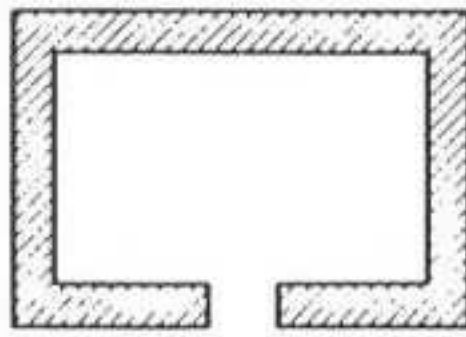
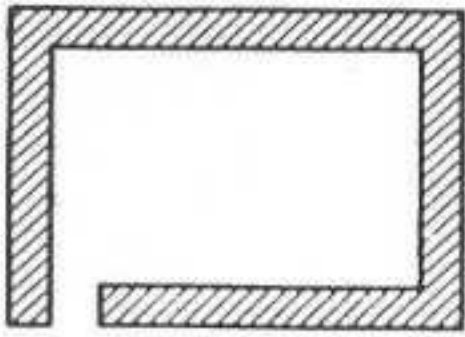
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FOR SEMI-HOLLOW EXTRUDED SHAPES

INSTEAD OF THIS

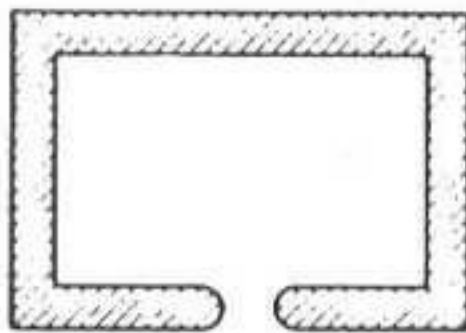
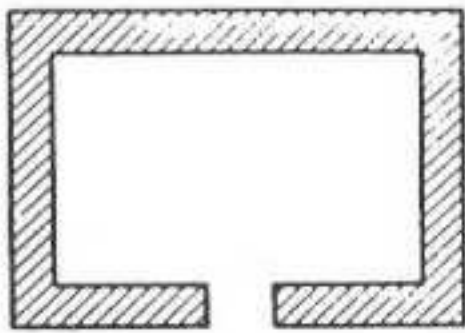
CONSIDER THIS

WHY



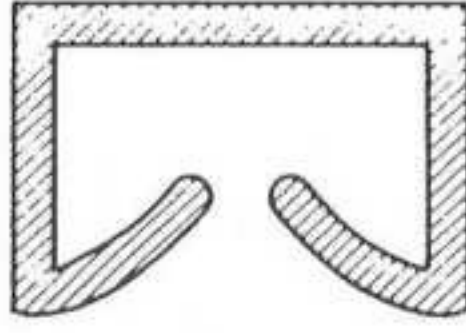
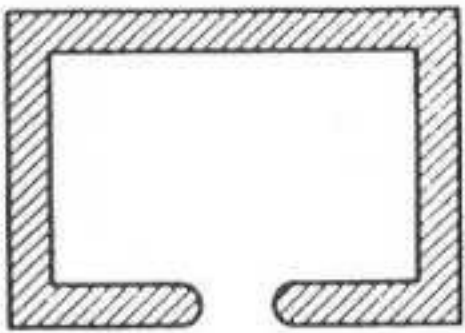
SYMMETRY PREFERRED IN SEMI-HOLLOW AREAS

When designing, visualize the die and the tongue that will be necessary to produce a semi-hollow shape. By keeping the void symmetrical you lessen the chances that the die tongue may break.



ROUNDED CORNER STRENGTHENS TONGUE

The preceding cross section has been further improved. The die tongue is now less likely to snap off.



REDUCE AREA OF VOID—1

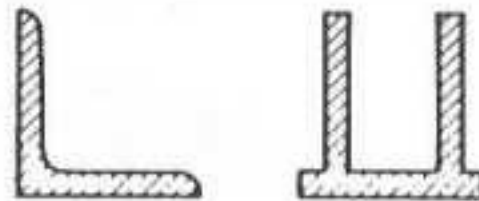
Further improvement results if outline can be changed to reduce area enclosed. Reduced area means less pressure on the tongue; easier extrusion.

CLASSIFICATION OF EXTRUDED SHAPES

The extrusion industry generally uses these classifications and terminologies for pricing. Cross sections are arranged according to the ease with which they can generally be extruded. Standard extruded rod, bar, or tubing are not termed *extruded shapes*, and are not included here.

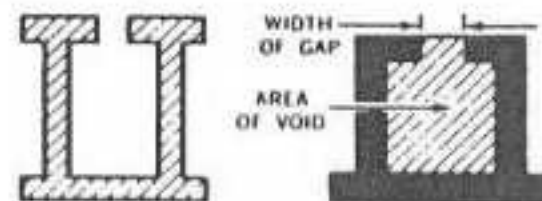
LOWER COST -----

SOLID EXTRUDED SHAPES



Defined as any extruded shape other than a semi-hollow or hollow. For this class, dies are easy to cut: Extrusion is fast: die does not require thin, weak tongues.

SEMI-HOLLOW EXTRUDED SHAPES



An extruded shape is semi-hollow when any part of its wall-section partially forms a hollow in which the ratio of the area of the void to the square of the width of the gap is:

Gap width, inches	Ratio
Less than .062	Over 2
.062 to .124	Over 3
.125 to .249	Over 4
.250 to .499	Over 5
.500 and greater	Over 6

If the ratio is less than shown above, the shape is termed a solid. Minimum gap width is .030 inch.



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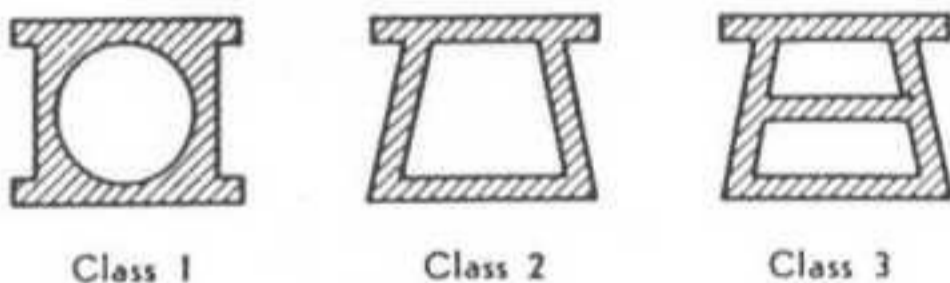
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INSTEAD OF THIS	CONSIDER THIS	WHY
		<p>REDUCE AREA OF VOID—2</p> <p>Here, wall thickness has been increased to reduce void area. Though more metal is used per foot of extrusion, the price per foot may be lower, depending on particulars.</p>
		<p>SEMI-HOLLOW CHANGED TO SOLID</p> <p>Better than the four previous suggestions, widening the opening into the void puts this shape into the solid classification and cuts production costs measurably. The die, if you visualize it, no longer has a fragile tongue.</p>
		<p>EXTRUDE A MODIFIED SHAPE</p> <p>If the design function prohibits any of the three previous suggestions, it may be possible to strengthen the tongue by extruding a modified shape; then repositioning before ageing.</p> <p>The above technique is also suitable for shapes that have deep narrow grooves.</p>

→ HIGHER COST

HOLLOW EXTRUDED SHAPES



Class 1

Class 2

Class 3

An extruded shape is termed hollow if any part of its wall-section forms a complete hollow. Further subdivision is as follows:

Class 1-Hollow Extruded Shape: A hollow extruded shape whose void is round and one inch or more in diameter, and whose weight is equally distributed on opposite sides of two or more equally spaced axes.

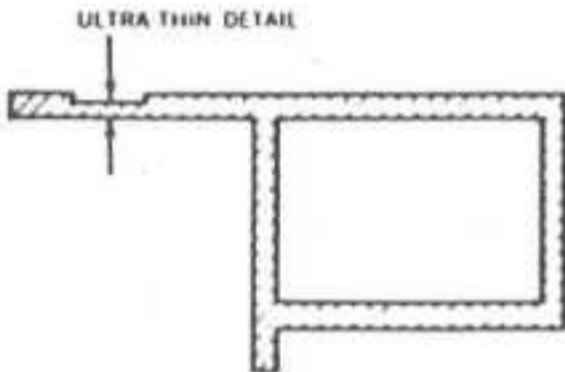
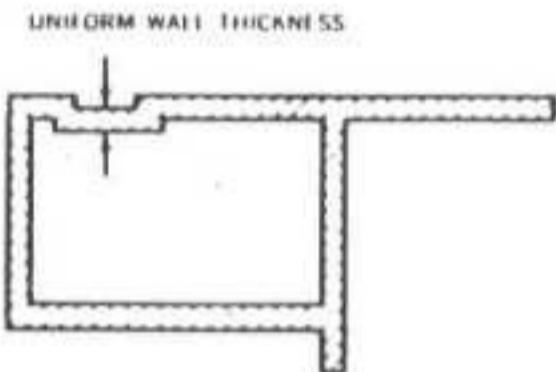
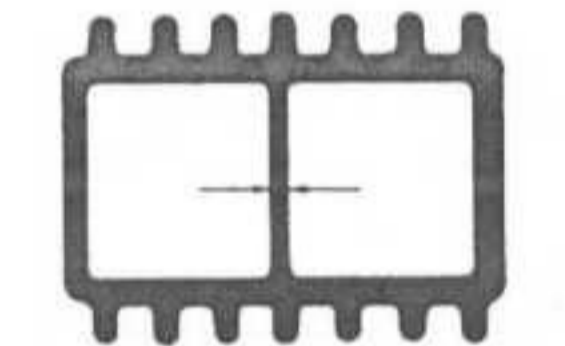
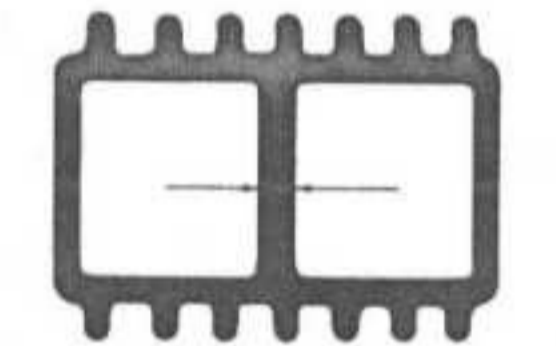

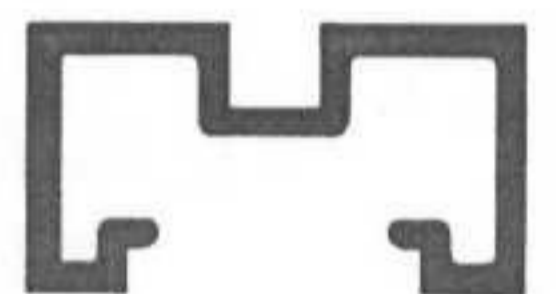
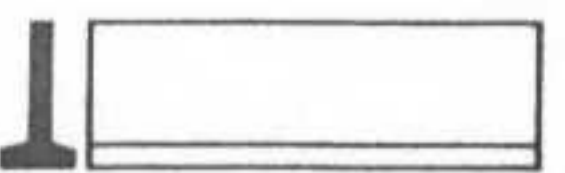
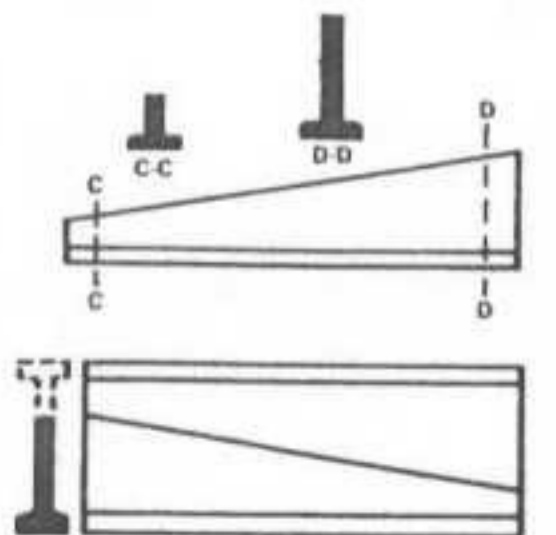
Class 2-Hollow Extruded Shape: Any hollow extruded shape other than Class 1, having a single void and not exceeding a five inch circumscribing circle in size.

Class 3-Hollow Extruded Shape: Any hollow extruded shape other than Class 1 or 2.

Note that a hollow extrusion whose wall is of uniform thickness, and whose cross section is completely sectional and is round, square, rectangular, hexagonal, octagonal or elliptical, with sharp or rounded corners is termed extruded tubing.



Design Tips - Page Six

INSTEAD OF THIS	CONSIDER THIS	WHY
 <p>ULTRA THIN DETAIL</p>	 <p>UNIFORM WALL THICKNESS</p>	<p>AVOID DETAIL AT THE END OF LONG, THIN RAIL</p>
		<p>THICKER WALL MAY BE LESS EXPENSIVE</p>
		<p>AVOID HOLLOW SHAPE</p>
		<p>LENGTHWISE CUT</p>

If thin detail is needed, such as the channel at the extreme left, you can:
1.) Move the detail closer to a support; or 2.) Increase wall thickness to prevent distortion; or 3.) Provide support at other end of the rail.

In a class 3 hollow extruded shape, such as this double compartment heat exchanger; a thin wall between the two voids is very difficult and costly to extrude.

Hollow and multi-hollow extruded shapes are usually much more costly than the simple solid shape. Also less metal has been used.
(Note: Extruded bar, rod, or tubing of standard round, square, hex or octagonal shapes are not termed hollow extruded shapes and are generally less expensive than either solid or hollow extruded shapes.)

Tapering sections are obtained from this lengthwise cut. These may serve as stiffeners, permitting maximum weight economy.



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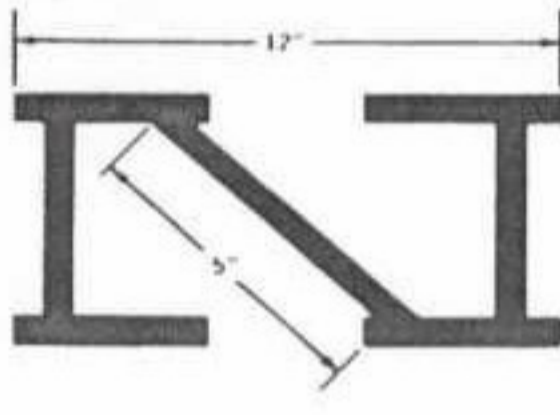
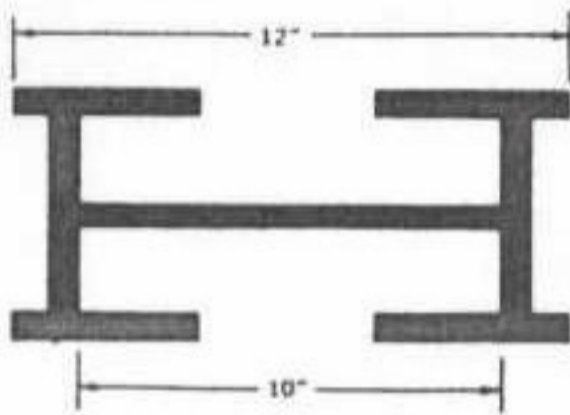
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INSTEAD OF THIS

CONSIDER THIS

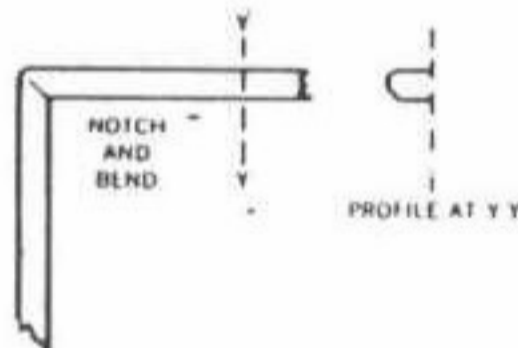
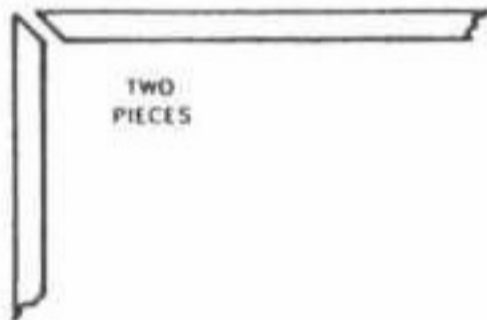
WHY



KEEP PERIMETER/CROSS SECTION AREA RATIO AS LOW AS POSSIBLE

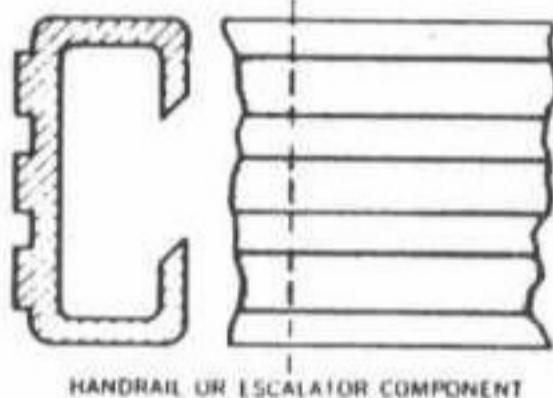
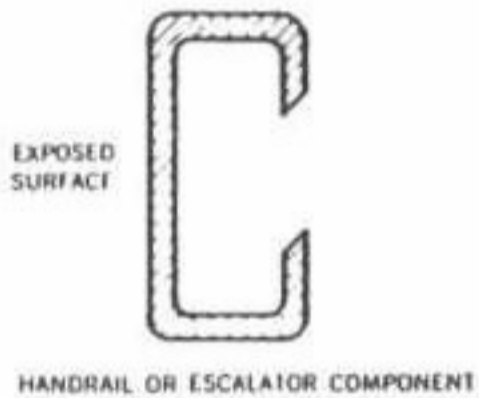
Extruders often measure complexity in terms of the amount of perimeter for a given weight (or cross section area) of metal.

In this example, 10 inches of perimeter has been saved by reducing the length of the cross member from 10 inches to 5 inches.



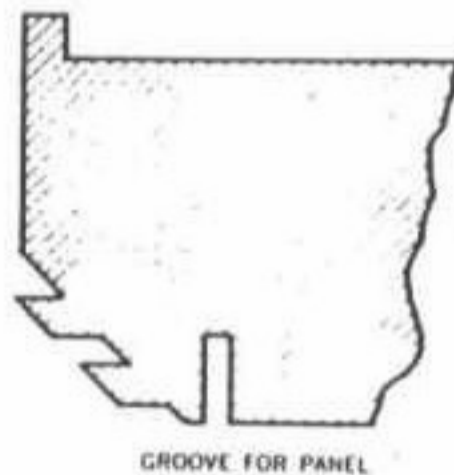
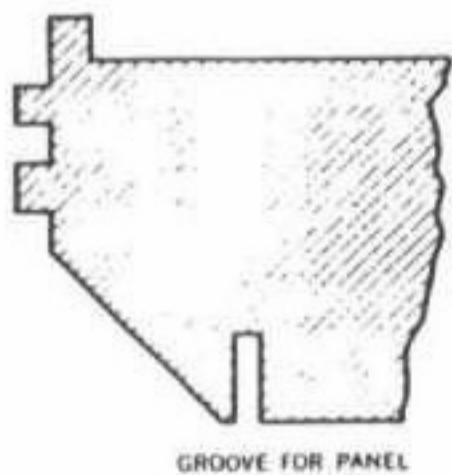
CORNER ASSEMBLIES

Notching permits unbroken outer edge, replaces two pieces with one.



PARALLEL LINES ADD ILLUSION OF LENGTH

With little extra effort or cost, designers can add grooves, ridges, or other decorative detail. Either the grooves or the raised surfaces can be colored to emphasize contrast.



PLACE RIBS AT POINTS OF MAXIMUM STRESS

On this extruded frame, ribs have been moved nearer the panel groove because deformation of the bevel portion would result in a loose panel.



STREAMLINED WEB IMPROVES SURFACE FINISH

Sudden changes in metal thickness of a flange or web can leave blemishes on the opposite surface, especially if the section is thin. Anodizing will not cover these defects.



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INSTEAD OF THIS	CONSIDER THIS	WHY
	<p>Lap Joints</p> <p>Lap Lock Joints</p> <p>Cylindrical Sliding Fits</p>	<p>SOME EXTRUSION JOINING METHODS</p> <p>Simple lap joints 1 and 2 are used for positioning only and depend on an external fastener or other joint to hold them in place, as in 3.</p> <p>In item 4, part A is moved in and up, then spline B is inserted to lock the joint securely.</p>
		<p>At 10 is a slide fit with rounded locking shapes. This may be removable under some conditions. The flat locking edges in item 11 generally require less deflection for assembly than in item 10.</p>

CHECK THIS LIST BEFORE COMPLETING YOUR DRAWING

- A 1/64" radius on fillets and corners greatly improves extrudability as compared to sharp corners.
- Specify exact lengths needed, such as: "Furnish in lengths of multiples of 60 inches."
- Indicate all exposed surfaces on the drawing as these require special attention.
- Show the function of the piece and the parts that will mate with it so your extruder can suggest economical changes.
- Do not list special tolerances unless you really need them. Be sure to use extrusion tolerances, and not tolerances that you have memorized from some other process.
- Specify finish required and whether to be performed by the extruder or not.
- Specify exact alloy wanted.
- Consult your extruder. What may be a difficult fabrication from your point of view could be easy for him. And vice versa.