VR3 Engineering: CNC Tube Notching Process

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Introduction and Purpose:

The purpose of this document is to explain and list out the features, and advantages of VR3'S Unique, CNC Tube Notching process. Our "CNC Tube Notchers" are designed, detailed, manufactured by VR3, and therefore can maintain, adapt or find solutions / new manufacturing techniques to fulfill special requirements.

Features / Advantages:

1. VR3 follows a unique method of extracting the cutting profile data direct from a 3D model which, evaluated the wall thickness, and intersection geometry to ensure 100% contact around the perimeter.
2. This is a Cold cutting process hence, no heat affected concerns.
3. Tube notches are machined with our custom in-house built CNC notching machines – this is not laser cutting.
4. These Clean, CNC machined cut surfaces are ideal for weld assembly.
5. No surface impurities resulting from the cutting process.
6. Unlike Laser cutting, Splatter and heat affected zones are non-existent.
7. Ideal for small diameter tubing: from 0.250" OD to 2.000" OD.
8. Ideal for materials such as carbon steel, 4130N, aluminum, titanium, 15CDV6.
9. Suitable for any "machinable" material.
10. Efficient and cost effective for low volume and prototype parts; from 1's to 100's of parts.
11. Both ends of the tube, and all intermediate features are made in one automated setup with one cutting tool.
12. 100% repeatability and reproducibility of parts.
13. No handling, storage and maintenance of special tooling required.
14. Each tube part has a unique CNC program "soft tooling", simply saved and catalogued for future orders; Shallow intersecting angles of 20 degrees or less are easily produced.
15. Simple, safe, reliable and economical for high quality, low-to-mid volume requirements.
16. Pre-notched and oriented tube features prior to tube bending producing tubes ready for weld assembly immediately after bending in most cases.
17. Tubes are cut with a unique toolpath perpendicular to the surface of the tube, eliminating 'feathered' ends, and creating an ideal fit for welding.
18. Parts are clearly labelled with part number, material description and order information.
19. Parts are grouped and packaged in sets or kits to facilitate downstream weld assembly.
20. Eliminates precutting of tube lengths for parts.

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21. Facilitates Optimal use of full-length raw materials and / or shorts.
22. No fluid leaks, no mess! No cutting fluids are used and therefore cleaning parts or the CNC machine is eliminated.
23. Ideal for wall thicknesses of .020” to .125”.
24. Adaptable for large diameter parts (>2.500”) in ‘short’ lengths.
25. Ideal for development projects as fixturing and downstream assembly are simplified by us!
26. Precision notching creates gapless fit-up resulting in minimal shrinkage and distortion during welding hence, our process is ideal for “precision tube fabrication”.
27. Capable of notching square and rectangle tubes up to 1.500” square or 1.00”x2.00” rectangular.
28. Addition of vent holes or locating features is done during the same setup with the same notching tool.
29. End notch and mid tube feature cutting data is extracted directly from the 3D CAD file, eliminating human factors.
30. Almost all tubes use only one cutting tool, a 0.125” diameter end mill.
31. Geometry and complexity are virtually unrestricted for straight tube features!
32. Quick turnaround times, most small orders shipped within days of order.
33. Simplified fixturing: precision notched tubes function as “permanent” fixture components.
34. Tube sizes:
    - Round tube sizes from 0.188” to 2.000” od
    - Wall thicknesses from 0.028” to 0.120”
    - Lengths from 0.250” to 240.000”
    - Square tubes to 1.000” square
35. Our tubing kits are “ready to weld”, out of the box!!

Limitations:

1. Relatively slow for larger tube sizes greater than 2.000” diameter in high volumes (>100’s).
2. Limited to 0.125” wall thickness, except for special cases.
3. Machining C1008/C1010 materials, often used on square/rectangular tubes, with a 0.125”-diameter end mill does not work well. It is like “bubble gum” and plugs the small end mills. Although our process allows for virtually unrestricted geometries, it is best to reference our modelling guidelines to optimize parts for manufacture

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