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Features of the 'Cartesian Tube Profiling Process' **Oct 2008**

VR3 Engineering designed and built a cnc machine to profile tubes particularly suited for chrome-moly tubing. On the VR3 tube profiler, both ends of the tube are profiled in one setup to ensure accurate profiles, clocked orientation of both ends and controlled length tolerances.

1. The cut quality, accuracy and repeatability of each and every tube is unprecedented
   Each and every tube is profiled ready for weld assembly.

2. Profiling both ends of the tube in a single setup:
   This ensures accurate profiles, clocked orientation of both ends and controlled length dimensions to tolerances of +/- .005". Automated part handling and cnc control ensure the dimensions and orientation of all cut profiles in one setup. Eliminate multiple setups, specific tooling and operator judgment.

3. Accurate, clean cut surface
   A single end mill cutting tool produces the cleanest and most accurate cut surface ready for welding by profiling any contour or cut-out in all tube sizes.

4. Convenient kit of tubes:
   A kit of tubes is complete and ready for weld assembly. Each and every tube is clearly labelled and identified with a number and can be duplicated with 100% repeatability. Kits are easy to store, easy to ship.

5. Unrestricted geometry
   Shallow intersecting angles of 20 degrees or less are easily produced. The process is ideal for simple intersections or complex multi-tube clusters.

6. Eliminate manual tasks and related skills
   No measuring, layout, calculating, fitting, cutting, grinding and cleanup. An accurate tube is produced ready for weld assembly.

7. Eliminate designing, producing, storing and handling of templates and tooling.
   Electronic data replaces the need to design, manufacture, store and inspect templates and tooling

8. Simplified and more economical fixture requirements
   Profiled tubes become fixture components by holding critical dimensions and nesting tight at the intersecting clusters. Eliminate the manufacture of templates, tracing tubes, specialized tooling and measuring equipment.

9. Versatile Process
   Applies to any tube diameter, length, wall thickness and cluster configuration. Simple mitre joints or complex cluster profiles are produced with the same effort.

10. Repeatability
    Accurate and repeatable profiles and parts are produced every time using a cnc process. Minimal setup is required to produce different size tubes or profiles. This is a significant advantage when producing kits requiring many different tube sizes where two tubes are rarely identical.

11. Prototyping or one off specials:

Accurate first off weldments can be manufactured without designing and building expensive welding fixtures. The function, design and test weldments can easily be manufactured, simplified, tested and improved before spending time and money on production tooling and setups. Design and development cycle time is much shorter.

12. Weld sizes

Accurate and consistent fits allow for smaller and more optimum weld sizes resulting in stronger joints. Reduced filler metal and less heat input result in less distortion, shrinkage and welding stresses.

13. Metallurgy

Our process eliminates the rapid heating/cooling cycle typical of plasma and laser cutting methods and the resulting concerns particularly with thin wall (.028", .035", .049") 4130 tubing. There are no hardened edges, oxidized surfaces or heat affected zones which can lead to defects during the welding process.

14. Materials

Most materials including stainless steel, aluminium, titanium and 4130/chrome-moly tubing can all be profiled with our cold cutting process producing the cleanest cut edge possible.

15. Optimized use of raw material

Eliminate pre-cutting to approximate lengths
Shipping, handling and storage are all simplified.
Eliminate waste, scrap and rework of tubes and tubing structures.

16. Production Scheduling and Efficiency

Pre-cut sets of tubes are assembled in kits ready for tack welding and finish welding. Tubes are clearly identified and correct wall thicknesses verified before welding. This simplifies production and manpower scheduling and improves efficiency of everyone's time.

17. Addition of Features:

Holes, slots and cut-outs required for locating, venting or mounting are added simultaneously during the profiling process in the same setup to ensure positional accuracy and tolerances without additional setups.

18. Formed Tubes:

Pre-profiling of tubes to be formed or bent can also be produced in most cases using the data from the 3D model and bending prior to weld assembly.

19. Design Flexibility

Allows the designer to be more creative and optimize tube size, position or location to suit function without the worries of tooling. Nesting of different tube sizes flush to a plane surface is easily manufactured.

20. Square Tubes

Square tubes and other cross sectional shapes are profiled in the same manner as round tubes.

21. Shop Space

Less shop space is required. Shop floor remains cleaner, quieter and safer without cutting and grinding tools and residue. Eliminate clutter from cords and air lines.

22. Welding Personnel

Welders can focus welding instead of measuring, grinding, fitting, searching for material or

checking wall thicknesses. Work space will be clean, quiet and productive.

23. Save time and be more productive at every stage of the manufacturing.
    Accurate, consistent and organized tube components set the standard and simplify every step in downstream production.

24. Design Creativity
    This technology allows the designer flexibility to be more creative and optimize structures without the worry of designing and selecting specific tooling and fixtures.

25. Simplify production control and scheduling.
    One number identifies a set of tubes ready for a weld assembly. Scheduling of material and labour requirements is simpler and traceable.

26. VR3 Engineering Support
    VR3 generates the cutting profiles from the customer's 3D models or produce the 3D models from customer drawings, dimensions and material lists
    VR3 produces the first-off sets of tubes for development projects or supply production quantities of profiled tube components and kits.
    VR3 designed detailed and manufactured a specialized custom cnc machine. This allows us to maintain and modify the machine and programs to suit special requirements.
    Cutting profiles are generated direct from computerized 3D solid models to maintain dimensional accuracy, nested intersections and detailed profiles.
    VR3 developed a unique method of extracting the cutting profile data direct from a 3D model which evaluates the wall thickness and intersection geometry to ensure 100% contact around the perimeter. This is unlike most software which follows an outside, inside or midpoint path and treats this as a flat surface.

27. Tube Sizes
    Round tubes from 0.250" od to 2.000" od
    Wall thicknesses from .028" to 0.120"
    Lengths from 0.250" to 240.000"
    Square tubes to 1.000" square

28. Documentation Package
    Each kit includes well organized and traceable documentation including drawings, material lists, and material test reports to compliment manufacturer's drawings or original design plans.

Both ends of the tube are cut in one setup with one tool to ensure the accuracy and orientation on the profiles, the end clocking, positioning of holes and the tube length. This eliminates confusion with LH/RH and CW/CCW orientations.

Tubing Kits, 'ready to weld' out of the box !!!