



## Centrifugally Cast Hydraulic Cylinders

### Discussion of Benefits

#### **Background:**

For nearly 30 years, Spuncast, Inc. has produced hydraulic cylinder bodies for OEM suppliers to heavy equipment manufacturers. By far the largest market for these bodies is the Mining Industry, specifically large off-highway mining vehicles. Three of the world's leading manufacturers of 150 Ton to 400 Ton Large Mining Trucks utilize Spuncast's expertise for rear and front strut bodies and telescoping dumper cylinders. In addition to large trucks, the company also casts hydraulic bodies for Large Wheel Loaders (currently up to 50 yd<sup>3</sup> bucket capacity). These castings are used for both bucket lift and bucket tilt cylinders.

Other applications include shear and crusher cylinders for demolition or steel recycling applications; riser tensioner cylinders for offshore oil platforms; building stabilizer cylinders for earthquake protection and many other uses.

The starting tubes used in the production of hydraulic cylinders can be produced by several processes. Hot milled tubing, forged tubing, rolled and welded tubing, even tubing machined from bar stock can be used but many customers have found cost/value benefits by using centrifugal castings. In many of the above applications, centrifugal castings replaced forgings.

#### **Benefits:**

##### **1. Integrally Cast Flanges**

The centrifugal casting process allows some shaping of the outer diameter of the workpiece. As long as the shaping is graduated in a manner to allow the part to be removed from the die, the shape can be cast integrally. This feature was an important factor in the off-road truck manufacturers switching from welded construction to centrifugals. Typically, large heavy walled cylinders are flanged to accommodate the high pressures exhibited on the end seals. Welded construction utilizes seamless tubing or forged tubing (often economical when purchased in quantity) with a forged flange welded on one or both ends.

This assembly must then subsequently go through post weld heat treatment to achieve acceptable mechanical properties. The weld must be full

penetration for safety reasons. In many cases, the manufacturer requires radiographic inspection or at a very minimum, ultrasonic inspection of the welds. The integral flanges do not require this level of inspection. An integrally cast flange from the centrifugal process will achieve strengths in excess of four times (4X) that of the welded/heat treated equivalent. For this reason alone, manufacturers have readily accepted centrifugal castings for their critical cylinder bodies.

## **2. Quantity Flexibility**

As already mentioned, seamless, DOM or tube mill tubing can be very economical when purchased in large quantities or “mill runs”. Because each centrifugally cast tube is usually an individual furnace heat, single piece or small quantities do not drastically change the price. While large regular runs are easily accommodated, centrifugal castings are also suited to smaller, job-specific runs.

## **3. Delivery of Non-Standard Sizes**

The centrifugal casting process lends itself extremely well to non-standard sizes. The dies, while not inexpensive, are manageable both financially and in lead time. The centrifugal die shapes and sizes only the outer diameter of the casting while the amount of molten metal poured sizes the inner diameter. When engineers design cylinders for a specific duty, there are many times when standard pipe sizes are not available. The diameters may not be available or the desired wall thickness may not be available. Centrifugal castings are an excellent solution to this dilemma.

## **4. Alloy Flexibility**

This is an outstanding benefit for using centrifugal castings in hydraulic cylinder applications. Through metallurgical control and a quench facility designed specifically for cylindrical steel parts, Spuncast is able to achieve extremely good and extremely repeatable mechanical properties from high strength, low alloy steels. This makes centrifugally cast tubes usable in a wide variety of high pressure applications.

It is also possible to pour high strength stainless alloys such as CA6NM, 17-4PH, duplex stainless steels or super duplex stainless steels. Spuncast has the metallurgical experience to pour these alloys. The CA6NM and

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duplex alloys can be certified to ASME specifications for pressure vessel code applications.

**5. Availability of Heavy Wall Thickness**

Centrifugal casting facilitates the production of heavy walled cylinders. Wall thicknesses of 30 mm to 65 mm are possible and common. Other methods of manufacturing are either not capable of these dimensions or will be cost prohibitive. Centrifugal casting offers an economical means to meet design requirements.

**Summary:**

There are numerous processes that are used to produce hydraulic cylinder bodies. Each can be appropriate and economical in specific situations. The benefits outlined here show that the centrifugal casting process definitely should be considered when designing and purchasing cylinder bodies. The consistent quality produced by Spuncast has allowed us to achieve an exemplary service record. In the nearly three decades we have supplied the mining trucks and wheel loaders with cylinder bodies, there have been NO warranty claims on these parts. The employees of Spuncast are extremely proud of that statistic.

Spuncast Sales Engineers are available to help determine if centrifugal casting would be an economical option for a particular hydraulic application. For additional information visit our website at <http://www.spuncast.com> or contact us at 888-367-3750 or [sales@spuncast.com](mailto:sales@spuncast.com) .