

## High Accuracy Bulk Bag Filler Provided to World's 1st Industrial Scale Nanotube Manufacturing Facility

### Customer Requirements

**Nanocyl S.A.** was established in 2002 in Sambreville, Belgium with the goal of becoming the leading global manufacturer of specialty and industrial Carbon Nanotubes. Nanocyl has become one of the key players in its industry with a production capacity of over 40 tons/year. Further capacity increases are being planned to meet the ever-growing customer demand. Nanocyl employs 40 people at its production facility in Sambreville and in their North American office in Alpharetta, Georgia.

Nanocyl manufactures a full range of Carbon Nanotubes including single-walled, double-walled and multi-walled versions. The preferred manufacturing method is catalytic carbon vapor deposition (CCVD), which is currently best adapted to large-scale production. Nanocyl commercializes its products in the form of powders, pellets, liquid dispersions and films.

Nanotubes are an emerging technology. They are expensive to manufacture and therefore command a high price in the market. Whether sold in full Bulk Bags or in 4.4 lb. (2 kg) packs, high accuracy is essential in filling the commercial containers. To do this, Nanocyl needed an extremely high accuracy filling machine for their bulk bags.

### Spiroflow Solution

Traditionally, for most industrial applications, Spiroflow offers Bulk Bag Fillers with weighing platforms that use weigh-scales or load-cells. Accuracies are typically +/- 2.2 lb. (1 kg). To meet Nanocyl's weighing accuracy requirement of +/- 0.7 oz. (20 g), Spiroflow engineers decided to successfully adopt the 'hang-weighing' principle for this application. This means that the highly sensitive load cells could be mounted high up in the filler, properly out of harm's way.

Not only does the Spiroflow Bulk Bag Filler accurately weigh the contents into the Bulk Bags - it is so accurate that it's used to fill 4.4 lb. (2 kg) bags as well! Bulk bag filling takes place under a nitrogen blanket. A folded, flat bag is rigged onto the Bulk Bag Filler and then the bag is inflated with nitrogen. Given that ambient air is 78% nitrogen (by volume), the nitrogen displaced as the bulk bags are filled is vented harmlessly through a special filter unit into the atmosphere.

During filling, the base of the Bulk Bag Filler intermittently rises to vibrate the bag and then the base is lowered to allow weighing to continue. Once the target weight has been achieved and recorded, the bag is given its final vibration. Vibration is critical to ensure that the contents of each bag



General view of the Bulk Bag Filler



The inflatable filling head and quick release bag support latches are all part of the load cell mounted bag weighing frame

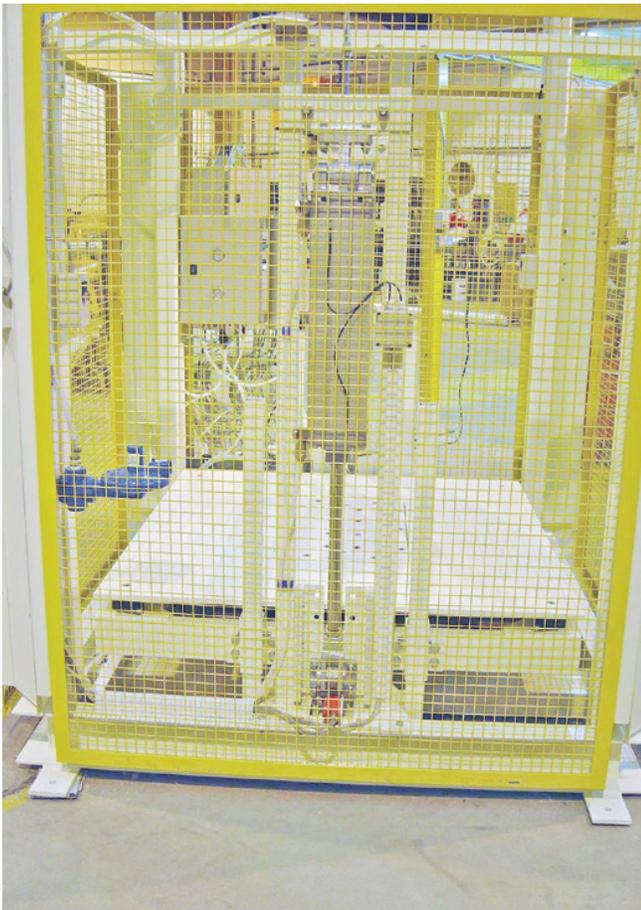
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are consolidated, making the bags stable and safe for handling and storage.

The controls were designed and manufactured by Spiroflow's dedicated team of electrical engineers and technicians. The heart of the control box is a highly accurate weighing instrument that receives signals from the high-sensitivity, high-accuracy load cells. These support the bag hanging frame and the quick release bag loop hooks.

The weighing instrument is connected to a printer, allowing batch records to be made and kept.

The Spiroflow Bulk Bag Filler has been operating since May 2007. "It is an excellent machine, custom-made by Spiroflow to meet our exact specifications," Nanocyl said. "It has been performing to our complete satisfaction making us extremely pleased."



Powerful pneumatic cylinders raise and lower the base that vibrate the bags

### What is a Carbon Nanotube?

A "Carbon Nanotube" is a tube-shaped material, made of carbon, with a diameter measuring on the nanometer scale. A nanometer is about one ten-thousandth as thick as a human hair. The graphite layer appears somewhat like a rolled-up chicken wire with a continuous unbroken hexagonal mesh and carbon molecules at the apexes of the hexagons. Carbon Nanotubes have many structures, differing in length, thickness, type of helicity and number of layers. Although they are formed from essentially the same graphite sheet, their electrical characteristics differ depending on these variations, acting either as metals or semi-conductors. Carbon Nanotubes typically have a diameter ranging from below 1 nm up to 50 nm. Their length is typically several microns, but recent progress has made them much longer in the centimeter range.

### What are the properties of a Carbon Nanotube?

The measurement on individual tubes due to their intrinsic mechanical and transport properties position them as ultimate carbon fibers. The best Carbon Nanotubes show a unique combination of stiffness, strength and tenacity compared to other fiber materials that usually lack one of these properties. Intrinsic thermal and electrical conductivity is also very high and comparable to other conductive materials.