How a semiconductor factory works

What does it take to build a fab?

One of the world's smallest technologies – semiconductors – is the backbone of technology today and in the future. Those tiny – but mighty – chips come to life in some of the largest, most complex factories. But what does it take to build a semiconductor factory? And why is it so complex? Let's find out.

A semiconductor factory, or “fab,” is a manufacturing marvel. Every hour, every day, the structure produces thousands of computer chips, the most complex products manufactured on Earth, and most not bigger than a fingernail. A typical fab includes 1,200 multimillion-dollar tools and 1,500 pieces of utility equipment. It costs about $12 billion and takes about three years and 6,000 construction workers to complete. Three of the fab’s four levels support the clean room, the home to chip production.

An inside look at the four levels of an Intel fab

First level: Interstitial and fan deck

The fan deck houses the support systems that keep the air in the clean room particle-free and precisely maintained at the right temperature and humidity for production.

Second level: Clean room level

A clean room is made up of more than 1,200 factory tools that take pizza-size silicon wafers and eventually turn them into hundreds of computer chips. Clean room workers wear bunny suits to keep lint, hair and skin flakes off the wafers.

Fun fact: Clean rooms are usually lit with yellow lights. They are necessary in photolithography to prevent unwanted exposure of photoresist to light of shorter wavelengths.

Third level: Clean sub fab level

The clean sub fab contains thousands of pumps, transformers, power cabinets and other systems that support the clean room. Large pipes called “laterals” carry gases, liquids, waste and exhaust to and from production tools. Workers don’t wear bunny suits here, but they do wear hard hats, safety glasses, gloves and shoe covers.

Fourth level: Utility level

Electrical panels that support the fab are located here, along with the “mains” — large utility pipes and ductwork that feed up to the lateral pipes in the clean sub fab. Chiller and compressor systems also are placed here. Workers who monitor the equipment on this level wear street clothes, hard hats and safety glasses.

What does it take to build a single Intel factory?

The heaviest cargo is the 50,000-kilogram chiller. That is the equivalent of 12 average-size male African elephants. 600,000 cubic meters of concrete are poured, plus 75,000 tons of steel reinforcement. That is 2 times more than what was used to build the Burj Khalifa in Dubai. More than 1 million cubic meters of soil and rock are removed. That is the equivalent of 400 Olympic-size swimming pools.

35,000 tons of structural steel will be used. That is 5 times the weight of the Eiffel Tower. About 6,000 construction workers contribute their expertise. 9 million meters of cable is installed. That is a distance equal to 214 full marathons.

Where are Intel’s fabs?

Intel is upgrading or expanding new fabs in Oregon, Israel, Arizona and Ireland. New fabs are under construction in Ohio and planned for Germany.

Summary

• Semiconductor factories, or “fabs,” produce some of the most complex products on Earth.
• Fabs have four levels – the interstitial and fan deck, the clean room level, the clean sub fab level and the utility level – each with its own unique functions to bring semiconductors to life.
• Intel has fabs across the globe. And the company is growing its manufacturing footprint in the United States and European Union.

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