

Plastic Flow Binding Technology. Innovations by KSK.

KEIHIN SEIMITSU KOGYO CO. LTD. (KSK)



KSK'S PLASTIC FLOW BINDING TECHNOLOGY

Aluminum diecast parts are indispensable as structural parts that provide both lightweight and complex functions, but it is necessary to join them together with parts made of steel to attain wearability and strength. The most commonly used type of binding technology up until now has been bolt binding. This method requires holes to be drilled in both parts, and an assembly process to join them together with screws which, in turn, increases size, weight and the number of parts, and also leads to a rise in production costs.

In comparison, KSK's Plastic Flow Binding technology is a dream to come true: simple process, high precision, strong binding, light weight, and with excellent productivity. This has been acknowledged by the Japanese Society for Technology of Plasticity, which awarded KSK with its Medal for Innovative Technology in 2015.



NEW METHOD FOR JOINING PARTS...

Plastic Flow Binding is a new method of joining parts of different materials together by first machining grooves in the hard material. Applying pressure to the softer parts with a punch allows the soft parts to 'flow' into the grooves. This happens at room temperature, meaning it is a relatively simple cold-machining process which offers a high-strength and high-precision method of connecting parts. The technology sounds simple but because aluminum diecast parts lack ductility, i.e. the capacity for plastic deformation, there has until now been no such method for these materials. Plastic Flow Binding raises the elongation at break of aluminum diecast material (EN AC-46100/ADC12) from 1% to 18%. In tests of aluminum diecast and steel joints, a binding efficiency (breaking load/binding load) of 10%-23% and a leak tightness of >8 MPa has been confirmed*.

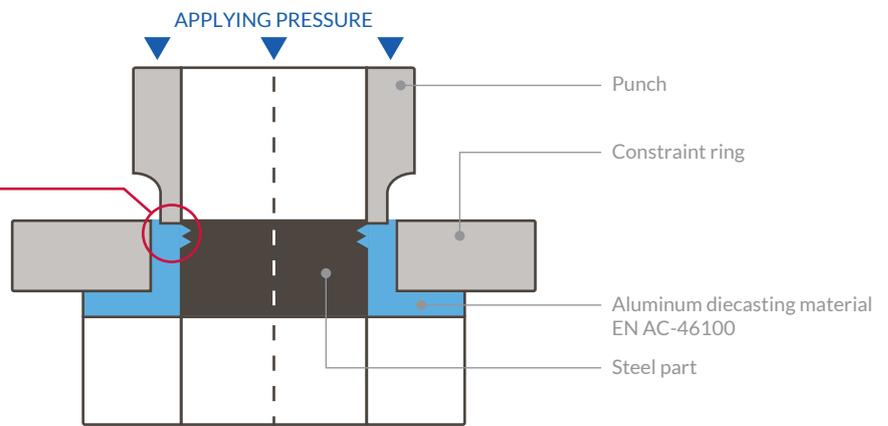
10%-23%

Binding efficiency

>8 MPa

Leak tightness

- ① Steel part
- ② Aluminum diecast part
- ③ Plastic flow



PRESS DIE STRUCTURE: The constraint ring prevents the widening of the aluminum diecast material. The compressive stress field inside the material leads to pressure strain and a plastic deformation of appr. 18% thus becomes possible.

* In order to prevent electrochemical corrosion, the steel-based parts are coated (with a ferrosferric oxide film).



In the case of the part described below, Plastic Flow Binding replaced the former bolt joining of parts and simplified the process: drilling is eliminated and assembly takes place on a standard press machine.

... WITH LARGE EFFECTS ON COST AND WEIGHT

KSK developed the technology for parts used in automobile engines. The first such part required a parallelism of 5/100-mm of a spline to the outer surface of the aluminum diecast actuator housing. This level of precision cannot be achieved by integrally casting in the steel holder part. While bolt binding was the method of choice before, the application of KSK's Plastic Flow Binding technology has drastically reduced costs and resulted in lighter weight of the actual part. Plastic Flow Binding is currently undergoing additional development, and technology to bind other materials together is also being developed. Patent protection has been acquired in Japan; international patents are pending.



0.83 kg
ACTUATOR HOUSING
Previous design: parts joined with three bolts

0.68 kg
ACTUATOR HOUSING
Current design: developed by KSK



Serial production started in February 2013 and has continued since with volumes of 20,000 pcs./month.



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