



Granite should pay attention to several problems in the precision mechanical design

Overview: Due to the excellent processing properties of natural granite, Adapt to saw, milling, boring, cutting, polishing, drilling, carving, etc.; Its high machining accuracy; Finish of about 100 degrees; Good wear resistance, The workpiece can move smoothly in the plane; Because of the high inertia of the stone material, Small coefficient of thermal expansion, The line expansion coefficient is 1 / 3 of the cast iron, Not easy to produce deformation, Slightly affected by the temperature, Large elastic modulus, Higher than cast iron; Large internal damping coefficient, Is 15 times larger than the steel, Therefore, it can have shock shock and shock absorption effect, Stone machinery can basically achieve no resonance phenomenon; The chemical properties of granite, Not prone to weathering, Resistance to acid, alkali and corrosive gases, The service life can reach about 150 years. Granite has many excellent properties such as no electrical conductivity, no magnetic conductivity and stable field position; but granite is brittle, only partial fall off after damage, and does not affect the overall smoothness.

Basic physical parameters of Jinan green materials:

Specific gravity: 2970 ~ 3070 kg/m³

Compressive strength: 245 to 254 N/mm²

Elastic modulus: 1.27~1.47x10⁵N/mm²

Line expansion coefficient: 4.61x10⁻⁶ / C

Water absorption rate: <0.013%

Shaw's hardness: above Hs 70

Problem 1: The design needs to consider the feasibility of the cost and the technology.

Material category and cost: granite, many kinds, internationally recognized can do precision machinery and precision measurement of granite species is not much, mainly Jinan green, American black granite, India M10 black granite, Shanxi black, international Zeiss three coordinates company, Japan, Hyde han company and Japan THK companies are using "green" Jinan granite, because Jinan green material is less and less, the American black granite and India M10, Fujian G654A also began to use. At present, all the products involved in precision measurement, as far as possible to use "Jinan Qing", such as the testing platform is very important, because it is the basis of identifying all products, once the foundation out of the problem, the whole quality system is not guaranteed. Therefore, when



designing measuring tools such as testing platform, the material grade must be the highest; for designing other precision mechanical accessories, we can choose cost-effective material design to reduce the cost from the source.

At present, the price ratio of the raw material price of black granite (waste material ruff block) is:

The price of Jinan Green (per cubic meter) =1.5 times India M10;

Jinan green price (per cubic) =0.5 times Shanxi black

Jinan green price (per cubic meter) =1.6G654A material.

After the above materials are tested, the shape variables are as follows (at a constant temperature of 21 degrees), and the highest maintenance accuracy (plane accuracy) of 1000 * 1000 * 150 thickness is as follows:

(Sample measurements :1000*1000*150)

	Maximum maintenance accuracy	50 KG per weight bearing, shape variable	characteristic
Jinan green	4-5 Microns	1 micron	High precision
M10 India	8 Micron	2 micron	Precision secondary
Shanxi black	10 Microns	2 micron	Beautiful appearance, high cost
G654A	15 Microns	Three microns	high performance cost ratio
Zhangqiu black	40 Microns	5 Micron	Low cost
Other black granite stones	No data	No data	No data

The higher the accuracy of the measuring tools, the better, but the cost is also very high, precision mechanical products are calculated by the maximum cumulative error, stone

Planprocessing of material parts to 4-5 microns per meter, domestic granite manufacturers are generally not too difficult; if the parallelism and flatness require accuracy, there is no difficulty to 10 microns (1 silk or 1); if the planism and parallelism reach 5 microns and the material thickness is less than 150 mm, it is very difficult, and the cost is very high. This is also the reason why each one level of accuracy is 30% higher and the production cycle is doubled (with no energy production and high production conditions); the verticality is generally processed to 10-20 microns and the vertical accuracy



exceeds 10 microns, which is difficult measuring tools, difficult processing and high cost. In short, it is necessary to consider the overall accuracy of mechanical installation and reasonable decomposition of the accuracy of stone parts, so as to achieve the purpose of cost optimization.

Stone standard specifications and design cost

The material of granite because of the current versatility of the equipment and stone tools, its thickness and width have standard specifications and non-standard specifications as follows:

(Unit: mm)

thickness	width	remarks
10	30-1400	Stone universal tool within width 1400
20	Width over 1400 mm, is a non-standard product, requiring a knife	Over 1400 mm wide requiring a knife,
40		The knife formation material is greatly wasted. At present, the knife
60		The maximum width of the processing is 2,000 mm, and the length is about 10,000 mm. All large specifications of the processing cycle is long, the cost is high (about 30 days). The knife formation material is greatly wasted. At present, the knife
80		
100		
120		
150		
200		
250		
350		
Non-standard thickness		

In the design process, try to use the standard thickness and width, can effectively reduce the cost.

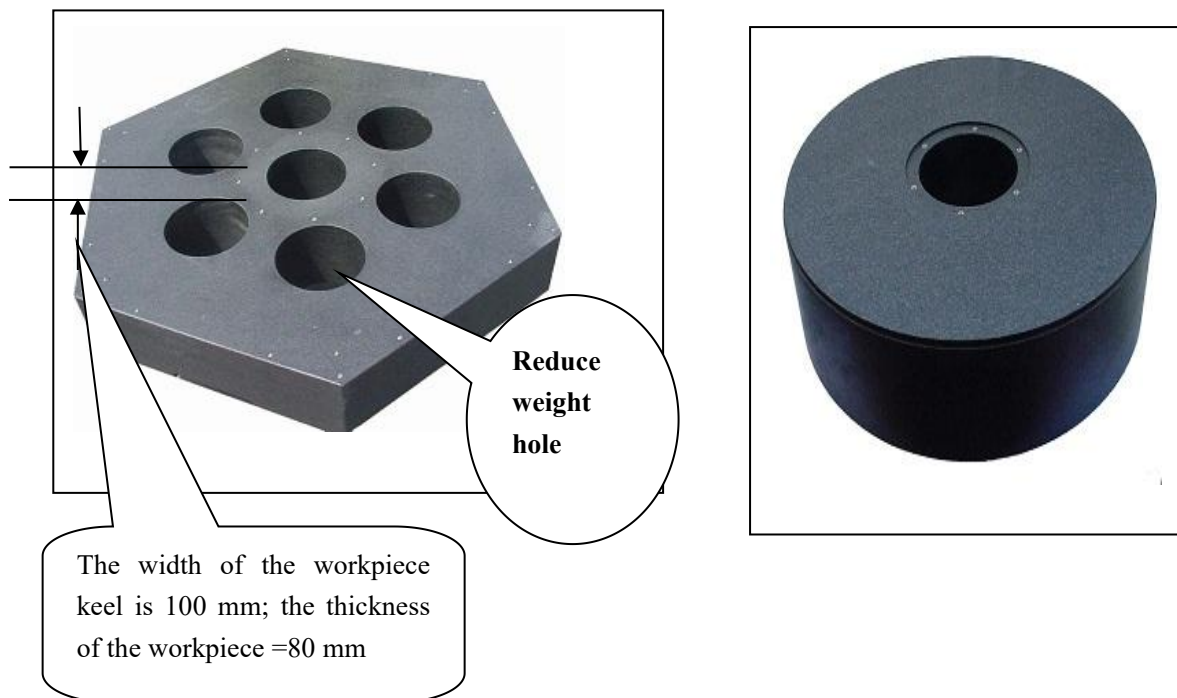
Problem 2: hole position distance from the edge / lifting hole

The distance between the hole and the edge: due to the disadvantages of easy granite collapse,



the distance between the hole and the edge is generally not less than 100 mm. The thickness needs to be determined according to the size and weight of the workpiece and the weight borne. If it is a continuous row of the rail, it can be close to the edge, but the most edge of the hole is also best more than 20 mm.

Reduce the weight of empty, and the width of the keel left is generally controlled at about 100 mm, if the weight of the stone accessories is very large, each square bear 1 ton, it is necessary to increase more than 150 mm.



Lifting hole If the stone plate surface is rectangular, the lifting hole is usually designed in the long side of the 3, in the center of the starting point of the power drill lifting hole, the size and depth of the lifting hole need to be installed according to the weight of the stone itself and accessories, the group of independent combination needs the total weight of the lifting.

Granite components	Screw hole diameter	Hole depth
800*800*80Below, bearing the weight of below 200 KG	M12	30MM
1000*1000*100-800*800*80, Below 200 KG	M16	40MM
1000*1000*100-2000*2000*250	M24	50MM
2000*2000*250-2000*3000*250	M30	80MM



Problem 3: connection and fastening problems

The step hole was used for the T-type connection

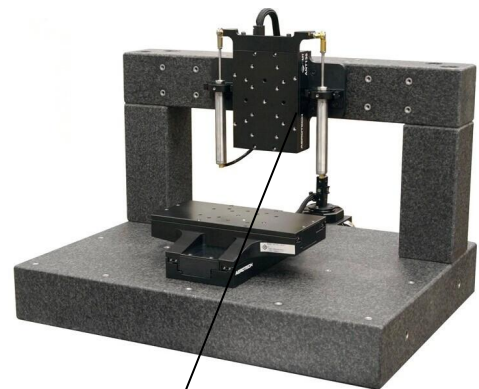


Floor
connection hole

Use the stone foot as the flange connection



Do stone column "" foot
", and then the foot on the
4 screws fixed



Make stone columns for
through holes, and then
from the floor to

Slot in the column for bolt fixing

If the thickness is 150 mm below, usually using the floor inlay nut, the connected piece through the step hole to complete the connection, if some fruit.

The formation of the workpiece nose space planning for other purposes, can also be hollowed out in the column, beam center, hole design screw connection and other ways.