

# Discussion on Improvement of PT Series Rear Swing Arm Low Pressure Casting Pouring System

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**Abstract:** The PT series rear swing arm low-pressure casting pouring system scheme adopts a metal mold casting for the outer mold and a sand core forming for the inner cavity. It adopts a dual riser and dual gate, and an open pouring system. During small-scale production, after 100% X-ray inspection, it was found that shrinkage defects were concentrated in the overlapping area. The group increased the thickness of the transverse pouring channel of this building from 31mm to 35mm; Fully apply 7029 insulation coating to this pouring channel to reduce mold cooling and ensure smooth filling and contraction channels. Afterwards, the shrinkage ratio significantly decreased, and the 100% pass rate of product X-ray inspection increased to over 95%, proving the effectiveness of this plan.

**Keywords:** rear swing arm, low pressure casting,

gating system, defect analysis

## 1 Question raising

The PT series rear swing arm products produced by our company require 100% X-ray inspection to be defect free in key areas. During the small-scale production stage, there were defects in the inspection, with a qualification rate of only 75-80%, which could not meet the delivery conditions for batch production.

## 2 Product conditions

### 2.1 Product pouring system

This product is produced by aluminum alloy die-casting method, as shown in Figure 1. The outer mold is cast with a metal mold, and the inner cavity is formed with a sand core. It adopts a double riser and double gate, and an open pouring system<sup>[1]</sup>.

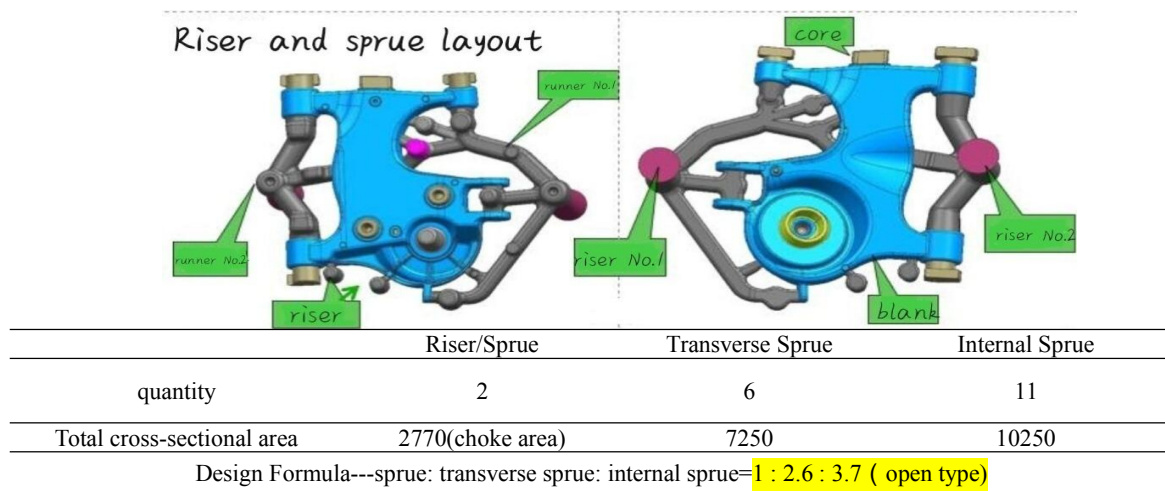


Figure 1 Process plan for PT series rear swing arm

## 2.2 Defects that occur during small-scale production processes

During small-scale production, after 100% X-ray inspection, it was found that shrinkage defects were concentrated in the overlapping areas. The distribution of product waste is shown in Table 1.

The inspection results of the loosening position of the PT series rear swing arm are shown in Figure 2.

## 3.1 Analysis of shrinkage and looseness at the junction

A typical hot spot is formed at the junction of this joint and the circular wall. During pouring and filling, it is at the end of the runner. After the casting is filled, the temperature at the end of the runner is low, and the filling ability of the runner to this joint is poor, resulting in shrinkage and looseness of the product at this point<sup>[2]</sup>.

## 3 Analysis and improvement of the causes of defects

Table 1 Inspection Record of PT Series Rear Swing Arm

The Critical area						
Tie Zi Shrink Loose	Bearing hole 1 air hole	Bearing hole 2 air hole	Shrinkage and looseness of bearing hole 2	Bearing hole 3 air hole	Large disk	the remaining
55	4	1	1	1	31	24
Non-Critical areas		The Others		Inspection quantity	Qualified quantity	Qualification rate
Disk R porosity	the remaining	Rotten sand	Lack of meat/def ormation/ cold insulation			
1	2	1	1	621	499	80.4%

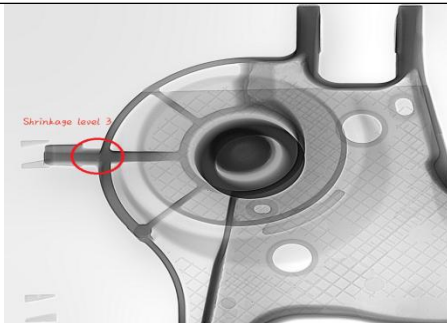


Fig.2 Results of Flaw Detection for Shrinkage Position

### 3.2 Rectification plan

Determine improvement plan after group discussion:

1) The thickness of the transverse sprue for this scaffold has been increased from 31mm to 35mm, as shown in Figure 4.

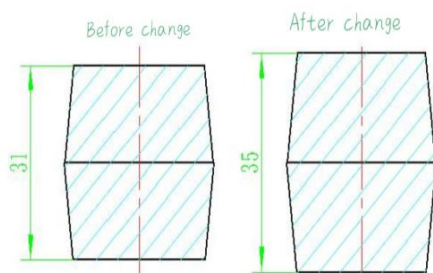


Fig.3: Increasing the thickness of the transverse runner

2) Fully apply 7029 insulation coating to this pouring channel to reduce mold cooling and ensure smooth filling and contraction channels.



Fig.4 Horizontal pouring channel coated with insulation paint

### 3.3 Verification of Improved Results

After improvement according to the analyzed plan, production verification was carried out, and the shrinkage and looseness ratio of this product was significantly reduced. The 100% pass rate of X-ray inspection of the product was increased to over 95%. After verification, it has been proven that this plan is effective and can meet the batch production conditions of the product<sup>[3]</sup>.

Therefore, improvements have been made to the same series of products according to this plan.

### 4 Conclusion

(1) Regarding the hot spot shrinkage at the far end of the casting, the cooling effect of the shrinkage channel needs to be considered.

(2) Properly thickening the sprue is beneficial for increasing the shrinkage effect.

(3) Reasonable use of insulation coatings can effectively slow down the cooling of the mold runner during the solidification process.

### References

- [1] Editorial Board. Casting Handbook (Volume 6, Special Casting) [M]. Beijing: Machinery Industry Press, 2021
- [2] He Y, Lu D, Li Z, et al. Multi-Objective Optimization of The Low-Pressure Casting of Large-Size Aluminum Alloy Wheels through a Systematic Optimization Idea[J]. Materials,2023,16 (18).
- [3] Liu B, Kang J, Yang X, et al. Effects of hollow sand mold on the microstructure and mechanical properties of a low-pressure aluminum alloy casting[J]. Journal of Materials Research and Technology,2024,28